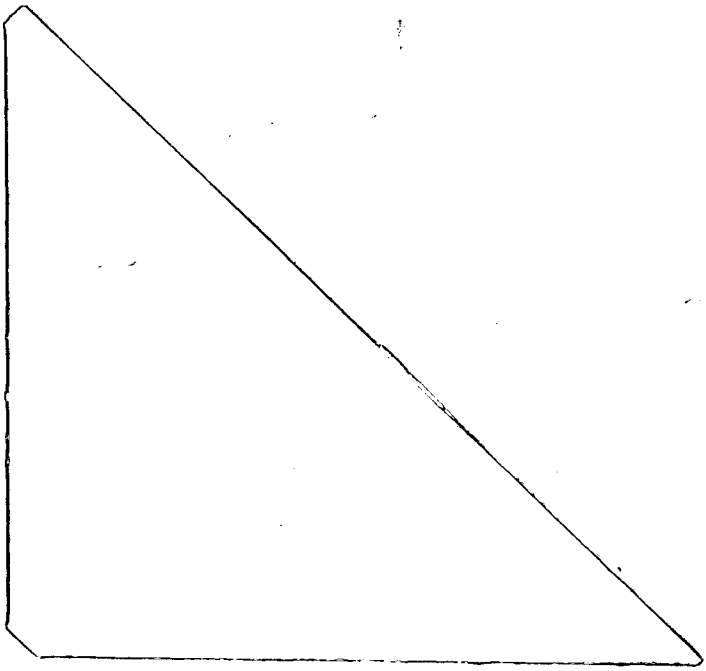
PLANT CELL BIOLOGY AND DEVELOPMENT 7

EDITED BY

M. KEDVES



Plant Cell Biology and Development

7

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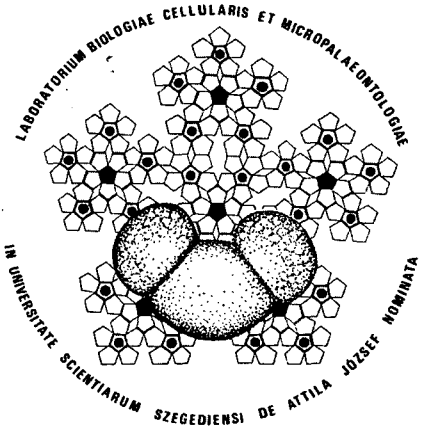

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Contents

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Preface

Five years ago Prof. Dr. B. CSÁKÁNY as the Rector of the J. A. University in his letter of 28B – 1990. Sz. O., dated 21th August 1990, recognized the functioning statutes of our laboratory. This was the official act of the legalisation of an earlier working group functioning on a multidisciplinary character.

Five years period is not a long time. But it is a hope that the activity of the laboratory was remarkable. The history of the laboratory was reviewed by A. TÓTH in this number, she is one of the most active young members as a university student, of the laboratory. To this occasion the symbol of the laboratory was also finished, and used for the first time on the previously published monograph. Moreover a commemorative medal of the laboratory and a diploma was founded for this occasion. The medal was made in 25 pieces, and will be presented to personalities as follows:

i. Personalities who render important assistance in the interest of the laboratory.
ii. Scientists working on similar or identical research programs, and who has world wide excellent, high standard results.
iii. Colleagues who are working on joint research programs with the laboratory.

For the first time three medals were awarded.

The first one was handed to Prof. Dr. B. CSÁKÁNY on the 18th August in my work-room in a very exclusive reception. The two others were offered to Mme. M. VAN CAMPO (Montpellier, France) and to Prof. Dr. W. KRUTZSCH (Berlin, German F. R.). I am very sorry that they could not come to Szeged because of several occupations, so the medals were mailed to their addresses.

Mme. M. VAN CAMPO as chief editor of the review Pollen et Spores, and the head of the Palynological Laboratory of the C. N. R. S. in Paris helped very effectually my scientific achievements in Palynology. During my stay in Paris (1966–1967) I had the chance to work in her laboratory. This and other facts influenced positively the activity of the laboratory for the time being. I am very glad that she wrote me among others the following: "La médaille est bien arrivée, elle est splendide et j'en suis très fière."

Prof. Dr. W. KRUTZSCH is an excellent scientist of the pre-Quaternary, mostly Upper Cretaceous and Tertiary Palynology. His first monograph published in 1959 on the spores of the Eocene layers of Geiseltal is at present also a basic work for the taxonomy of the fossil spores. This was followed by the famous series of "Atlas der mittel- und jungtertiären dispersen Sporen- und Pollen sowie der Mikroplanktonfor-

men des nördlichen Mitteleuropas." After six volumes this valuable monograph was broken, in consequence of strange circumstances, which are independent of Prof. Dr. KRUTZSCH's scientific activity. After the taxonomic activity of Prof. Dr. W. KRUTZSCH the paleophytogeographical concept must be pointed out, in connection with the evolutionary evenments of the angiosperms. Our scientific and personal contacts started at the beginning of the sixties, and I hope will continue for many years. When our laboratory was in the making he was the first visitor of this small research unit. I received from her also very nice letters, let me cite some sentences: "Sehr geehrter Herr Prof. Kedves, für die mir anläßlich der 5. Jahrestagung des Bestehens des o. g. Laboratoriums verliehene ehrenvolle Auszeichnung möchte ich mich bei Ihnen und Ihrer Universität auf das herzlichste bedanken. Ich fühle mich geehrt, daß meine wissenschaftlichen Arbeiten bei Ihnen in Ungarn auf solche Anerkennung gestoßen sind, daß Sie mich für würdig einer solchen Auszeichnung befunden haben."

On the 22th August an exclusive reception was in the laboratory of the students and colleagues working in the laboratory or are in scientific contact with our laboratory. On this occasion three laboratory diplomas were distributed for the following persons:

Dr. I. KINCSEK (Lecturer at the Biological Department of the J. Gy. High School, Szeged), for a very long time cooperation with her and her students.

A. TÓTH (University Student at the A. Szent-Györgyi Medical University, Szeged). She is one of the first secondary-school students who were pioneers of the youngest generation working for the realization of the scientific program of the laboratory. Her scientifical activity is well known.

Dr. I. BAGI (Senior Assistant at the Department of Botany of the J. A. University, Szeged). He is very helpful in the solution of the everyday problems of the function of the laboratory, moreover joint scientifical research programs were also realized.

The function of the laboratory is assured financially in the first place by Grants. First the importance of the Grant OTKA must be emphasized; OTKA 1/2–24/88, 1/3–104, 1/5 T 007206, 1/7 T 014692. The monographs of the laboratory and Plant Cell Biology and Development were supported by several Foundations and Institutions as follows.

Foundation for Szeged,
Regional Committee of the Hungarian Academy of Sciences,
Presidium of the Hungarian Academy of Sciences,
Hungarian Oil and Gas Industrial Company,
Foundation of the Science of the South Hungarian Plain,
Scientific and Higher-educational Committee of the Local Government of Szeged,
Hungarian Geological Society,
Faculty of Science of the J. A. University.

In this place I would like to express my sincere gratitude to the following personalities: Dr. D. KOSÁRY President of the Hungarian Academy of Sciences, Dr. I. LÁNG Secretary General of the Hungarian Academy of Sciences, Dr. GY. TELEGDY President of the Regional Committee of the Hungarian Academy of Sciences, Dr. T. BALOGH Secretary of the Regional Committee of the Hungarian Academy of Sciences, Dr. T. KECSKEMÉTI President of the Hungarian Geological Society, Mr. G. JÓZSEF business

manager of the Hungarian Oil and Gas Industrial Company, Mr. Cs. GALÁNFI head of department of the Hungarian Oil and Gas Company, Prof. Dr. B. CSÁKÁNY and Prof. Dr. J. CSIRIK as Rector of the J. A. University, Prof. Dr. I. DÉKÁNY, Prof. Dr. I. NAGYPÁL and Prof. Dr. B. RÁCZ as Scientifical Vice Rector of the J. A. University, Prof. Dr. R. MÉSZÁROS and Prof. Dr. K. VARGA as Dean of the Faculty of Science of the J. A. University.

The present number was supported by the Grant OTKA 1/7 T 014692, by the Faculty of Science of the J. A. University, the Regional Committee of the Hungarian Academy of Sciences and by the CSIC – Instituto de Geologia Economica, Madrid, Spain, Projecto PB 92–0101. In this place I would like to express my sincerest thanks to Prof. Dr. GY. TELEGDY, President and Prof. Dr. T. BALOGH Secretary of the Regional Committee of the Hungarian Academy of Sciences, to Prof. Dr. K. VARGA, Dean of the Faculty of Science, Prof. Dr. C. ALVAREZ RAMIS and Lourdes GÓMEZ-ESCALONILLA, Consejo Superior de Investigaciones Cientificas, Universidad Complutense de Madrid, Instituto de Geologia Economica, Madrid, Spain.

Szeged, 28 December 1995.

M. KEDVES
Head of the Laboratory

TO THE 5TH ANNIVERSARY OF THE OFFICIAL RECOGNITION OF THE LABORATORY

A. TÓTH

Cell Biological and Evolutionary Micropaleontological Laboratory of the Department of Botany of the J. A. University, H-6701, P. O. Box 993, Szeged, Hungary

The Cell Biological and Evolutionary Micropaleontological Laboratory was established on the 21th August, 1990 in the Department of Botany of the J. A. University. At this time was accepted the functioning status of the laboratory, including the official nomination which is current at present too. But the research work started and continuted successfully at the present working place much more earlier. The official establishment of the laboratory was supported particularly by Prof. Dr. B. CSÁKÁNY Rector of the J. A. University, Ass. Prof. Dr. E. SZALAMIN, Vice-Rector of the J. A. University and Ass. Prof. I. GYÉMÁNT Vice Dean of the Faculty of Science of the J. A. University. Prof. Dr. M. KEDVES as the head of the laboratory undertook the absolutely not easy task to look for young talented persons and put them on its mettle in the laboratory, increase their knowledge, and broading their intellectual horizon. In this activity Dr. KEDVES was supported by the personalities as follows: Dr. J. BÁNFALVY director of the Radnóti Miklós Experimental Secondary School, Mrs. M. BOGÁTHY-EKE director of the boarding-school, and Dr. M. JURAY Head of the Education Section of the Council of Szeged.

As the result of this organization, together with several of my companions I managed to work in the laboratory as a secondary-school student. At the first glance I had the impression that this laboratory is a remarkable place. This is such a working place where the young people have free scope and managing by a man who is not afraid to share his knowledge with young people. When I am writing this commemoration, I mediate on what were my personal impressions and the first things which came in my memory, I remember the following. The laboratory may be characterized by very accurate work, succesful results, and good atmosphere, familiar frame of mind.

During the five years after the official recognition, the laboratory achieved results, which were presented succesfully at international scientific meetings. Several scientists from different countries visited the laboratory. Among them Prof. Dr. W. KRUTZSCH (Berlin, German F. R.), was the first. Later Prof. Dr. K. TAKAHASHI (Japan), Dr. S. YAZVENKO (Russia), Prof. Dr. D. SOUTHWORTH (USA), Dr. M. T. FERNÁNDEZ-MARRÓN (Spain), Dr. B. JELEN (Slovenia), K. DUJMONIĆ-KRIZMANIĆ, Dr. K. KRIZMANIĆ (Croatia), Dr. S. C. SRIVASTAVA (India), Prof. Dr. C. ALVAREZ RAMIS (Spain), Dr. M. PHILIPPE (France), and Dr. A. K. SRIVASTAVA (India).

Joint papers were published with the following foreign scientists: C. ALVAREZ RAMIS (Madrid, Spain), F. BARATTOLO (Napoli, Italy), A. BREZIGAR (Ljubljana, Slovenia), S. BUSER (Ljubljana, Slovenia), M. CAFFAU (Trieste, Italy), F. CIMERMAN (Ljubljana, Slovenia), K. DROBNE (Ljubljana, Slovenia), W. E. EL-SAADAWI (Cairo, Egypt), M. T. FERNÁNDEZ MARRÓN (Madrid, Spain), R. GALVANI (Trieste, Italy), B. JELEN (Ljubljana, Slovenia), M. E. MONTENEGRO (Trieste, Italy), R. PAVLOVEC (Ljubljana, Slovenia), J. PAVŠIČ (Ljubljana, Slovenia), C. PIRINI-RADRIZZANI (Genova, Italy). M. PLENIČAR (Ljubljana, Slovenia), PUGLIESE, N. (Trieste, Italy), SKABERNE, D. (Ljubljana, Slovenia), TURNŠEK, D. (Ljubljana, Slovenia).

After the establishment of the laboratory for the first time results were presented at the 8th A. P. L. E. Symposium (Tenerife, Canary Island, Spain). Then for more than one year several young secondary school talents worked in the laboratory, among others: E. FARKAS, Gy. FÁBOS, A. BELLON, Á. SCHMÉL and P. AILER. Among the graduated researchers Dr. I. KINCSEK, Dr. M. HETÉNYI, Dr. M. MONOSTORI, Dr. G. GÉVAY, Dr. I. BAGI, Dr. Á. SIEGL-FARKAS, and Dr. Cs. SAJGÓ increased the scientific reputation of the laboratory. Traditionally very good contacts and scientific cooperation continuted with Prof. Dr. T. SZEDERKÉNYI, Prof. Dr. Á. PÁRDUTZ and Dr. I. ROJIK. Recently the first diploma thesis was made in the laboratory by A. VÉR, and partially by L. KEDVES.

After the first year of the official establishment of the laboratory the first number of Plant Cell Biology and Development appeared, which is at present also a popular edition. Particular merit of this series of publications is that the undergraduates received also place there. The number of the young people working in the laboratory further increased with numerous new middle-school students; A. HEGEDÜS, I. OLÁH, K. MÉSZÁROS, A. BORBOLA, O. BENN, T. GUBÁS.

E. GOTTL as a new young graduate worked in the laboratory.

In September 1991 laboratory results were presented at the XIIth A. P. L. F. Symposium in Caen (France), later at the 8th International Palynological Congress in Aix-en-Provence (France, in 1992). At this Congress several young undergraduates were co-authors of the presented contributions. At the end of this year in Las Palmas (Canary Islands, Spain) at the 9th A. P. L. E. Symposium the first results of the stabilizing biopolymer system of the metastable quasi-crystalloid skeleton were presented. This year I. GÁSPÁR started to prepare his diploma thesis in the laboratory.

In 1993 new results about the biopolymer symmetry were presented in Yokohama at the XVth International Botanical Congress. Not so late in Besançon, at the XIIIth A. P. L. F. Symposium combined studies on Holocene sediments were presented. The year 1994 was also succesful for the laboratory, new experimental results were presented at the Xth A. P. L. E. Symposium held in Valencia (Spain). In 1995 new young people started work in the laboratory, A. VARGA, Á. KÁROSSY and E. UNGVÁRI. At the 2nd A. P. A. I. organized in Tervuren two papers were presented on the results of the laboratory.

It is also important to mention the contribution of the laboratory assistants who worked during the last five years in the laboratory, namely I. BIRÓ-HALÁSZ, K. PÖLÖS, E. KOVÁCS, Zs. PAPP, recently Á. KÁROSSY.

It is the result of our collective work that we have the opportunity to keep the holiday of the laboratory. To the recognition of the value of the laboratory belong the awards of Dr. M. KEDVES founder of the laboratory. These are as follows.

1986, Salamanca (Spain): Medalla universitaria con el sello del Estudio, que se entrega en conmemoraciones o en atención a servicios distinguidos,

1995, Lucknow (Uttar Pradesh, India): Birbal Sahni Centenary Medal of 1995; Birbal-Savitri Sahni Memorial Museum Lucknow Silver Medal,

1995, Raleigh (North Carolina, USA): Man of the Year Commemorative Medal, 1995,

1995, Cambridge (England, UK): The Twentieth Century Award for Achievement: The Silver Medal of Honour.

I hope that based on the above mentioned facts the past five years of the Cell Biological and Evolutionary Micropaleontological Laboratory were succesful and the consideration of the results is positive. I wish, and I hope, that during the forthcoming periods the research work of the laboratory will continue with similar results.

1. PLANT MICROFOSSILS FROM THE UPPER CRETACEOUS AND LOWER TERTIARY LAYERS OF NORTHERN SPAIN II.

M. KEDVES

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Abstract

This paper presents the qualitative and quantitative palynological data isolated from the sediments of the locality of Quintanilla La Ojada – Losa Valley (Northern Spain). Three new form-species were described, these are the following: *Triangulotricolporites ibericus* n. fsp., *Plicapollis ibericus* n. fsp., *Retistephanoporites krutzschii* n. fsp. To evaluate the quantitative spore-pollen data the stratigraphical units of MARTINS (1988) were used. Regarding the preservation of the different samples very important differences were observed. The samples of the lower part of the sections (Santonian and Campanian) are very poor in sporomorphs, some *Normapolles* taxa (cf. *Complexiopollis, Praebasopollis* and *Vacuopollis*) represent the early *Brevaxonate* pollen grains. The basal layer is rich in *Dinokystes.* Remarkable occurrence of the *Hystrichosphaeridae* was observed at the middle part of the Campanian. Well preserved and rich pollen assemblages were observed in some samples of the U. Maestrichtian – Paleocene and Paleocene with several pecularities, as follows: 1. The characteristic boreal Maestrichtian *Normapolles* taxa (*Pseudotrudopollis* fspp., *Kriegeripollenites* fsp., *Hofkeripollenites* fspp., *Romeinipollenites* fsp., etc.) were not observed. 2. The richness of the form-genus *Ilexpollenites* is also unusual. 3. Several *Normapolles* and *Postnormapolles,* which are characteristic for the Paleocene layers were observed. From this point of view the form-genus *Stephanoporopollenites* must be emphasized. 4. The larger size of the *Normapolles* and *Postnormapolles* which was first published from the Paleocene sediments of Loksbergen was also observed here. Two Paleocene samples (Zone, G) are extremely rich in the cysts of *Hystrichosphaeridae,* and in several types of *angiosperm* pollen grains. One sample was investigated from the Eocene which is extremely poor in organic microremains.

Key words: Palynology, fossil, Cretaceous, Tertiary, Northern Spain.

Introduction

The history of the investigations of the Upper Cretaceous spore-pollen assemblages of Spain was shortly reviewed in a previous paper (KEDVES, 1994). The survey of the bibliographical data of the Paleocene and Eocene sediments of Spain will be the subject of the next contribution of this number (KEDVES, SOLÉ DE PORTA and MARTIN-ALGARRA, 1996).

This second part, which is at the same time the terminal paper of this program presents the LM data of the palynological data of the samples investigated from the upper part of the section Quintanilla La Ojada – Losa Valley. These slides were also sent me for palynological investigations by Dr. Ulrich P. MARTINS (Department

of Geology and Paleontology of the University Tübingen, R. F. Germany). The localisation of the sampling was illustrated in the Text-fig. 3.1., p. 30, the stratigraphical column with the sampling in Text-fig. 3.2., p. 32 in the above mentioned paper (KEDVES, 1994).

Material and Methods

The LM investigations were made on a JENAVAL (Carl Zeiss, Jena) instrument with oil immersion objective GF-Planachromat H1 100x 1,2500/0,17–A. The results will be presented in two parts:

1. The qualitative data follow the morphological taxonomy, based on the fundamental monographs of THOMSON and PFLUG (1953), PFLUG (1953b) and POTONIÉ (1956, 1958, 1960, 1966, 1970, 1975).

2. In the description of the quantitative data an attempt was made for the following points.

2.1. To present a general aspect of the composition of the palynomorphs. This is the basis for the reconstruction of the most important characteristic features of the vegetation surrounding the sedimentary basin.

2.2. The abundance of the *Dinokystes* and the *Hystrichosphaeridae* indicate marine conditions.

2.3. At every sample, the presence or the relative abundance of the stratigraphically important taxa is also enumerated.

Results

QUALITATIVE DATA
SPORITES

Perotrilites fsp., *Selaginellaceae, Selaginella* (Plate 1.1., figs. 1,2).

POLLENITES
LONGAXONES

Polycolpites transdanubicus KEDVES 1978, *Rubiaceae*, cf. *Carlemannia* (Plate 1.1., figs. 3,4),
Cupuliferoidaepollenites quisqualis (POTONIÉ 1934) POTONIÉ 1960, *Fagaceae* v. *Leguminosae* (Plate 1.1., figs. 5,6),
Retitricolpites fsp. A (Plate 1.1., figs. 7,8),
Retitricolpites fsp. B (Plate 1.1., figs. 9,10),
Psilatricolporites globus (H. DEÁK 1960) KEDVES 1978, *Sapotaceae* (Plate 1.1., figs. 11,12),
Cupuliferoipollenites pusillus (POTONIÉ 1934) POTONIÉ 1960, *Fagaceae*, cf. *Castanea* (Plate 1.1., figs. 13,14),
Intrabaculitricolporites circulus KEDVES 1978 (Plate 1.1., figs. 15,16),
Intrabaculitricolporites baculatus (KRUTZSCH 1961) n. comb. (Plate 1.1., figs. 17,18),

Basionym: *Tricolporopollenites baculatus* n. fsp.
KRUTZSCH 1961, p. 320; plate V, figs. 115–117,
Fig. 116, Plate 2, in KRUTZSCH, PCHALEK and SPIEGLER 1960.
Striatricolporites solé de portai (KEDVES 1965a) KEDVES 1978, *Fabaceae* (Plate 1.1., figs. 19,20),
Retitricolporites fsp. (Plate 1.1., figs. 21,22),
Foveotricolporites snopkovae KEDVES 1978, *Euphorbiaceae* (Plate 1.1., figs. 23,28),
Foveotricolporites gruas-cavagnettoae KEDVES 1978, cf. *Rhamnaceae* (Plate 1.1., figs. 24,25),
Foveotricolporites fsp. (Plate 1.1., figs. 26,27),
Ilexpollenites margaritatus (POTONIÉ 1931) THIERGART 1937 f. *medius* PFLUG and THOMSON 1953, *Aquifoliaceae* (Plate 1.1., figs. 29–32),
Ilexpollenites margaritatus (POTONIÉ 1931) THIERGART 1937 f. *minor, Aquifoliaceae* (Plate 1.1., figs. 33,34),
Tetracolporopollenites hungaricus KEDVES 1965a, *Sapotaceae* (Plate 1.2., figs. 1,2),
Pentapollenites pentangulus (PFLUG 1953a) KRUTZSCH 1958 subfsp. *crassicus* KRUTZSCH 1962, *Elaeagnaceae* v. *Simarubaceae* (Plate 1.2., figs. 3,4),
Pentapollenites pentangulus (PFLUG 1953a) KRUTZSCH 1958 subfsp. *foveostriatus* KRUTZSCH 1962, *Elaeagnaceae* v. *Simarubaceae* (Plate 1.2., figs. 5,6),
Pentapollenites laevigatus KRUTZSCH 1962 subfsp. *laevigatoides* KRUTZSCH 1962, *Elaeagnaceae* v. *Simarubaceae* (Plate 1.2., figs. 7,8).

BREVAXONES
NORMAPOLLES

Complexiopollis funiculus TSCHUDY 1973 (Plate 1.2., figs. 9–12),
Praebasopollis praebasalis GROOT and KRUTZSCH 1967 (Plate 1.2., figs. 13,14),
Psittacopollis elaeagnoides (ZAKLINSKAYA 1963) KEDVES 1967 (Plate 1.2., figs. 15,16),
Basopollis urkutensis KEDVES 1974 (Plate 1.2., figs. 17,18),
Basopollis basalis (PFLUG 1953a) PFLUG 1953b (Plate 1.2., figs. 19,20),

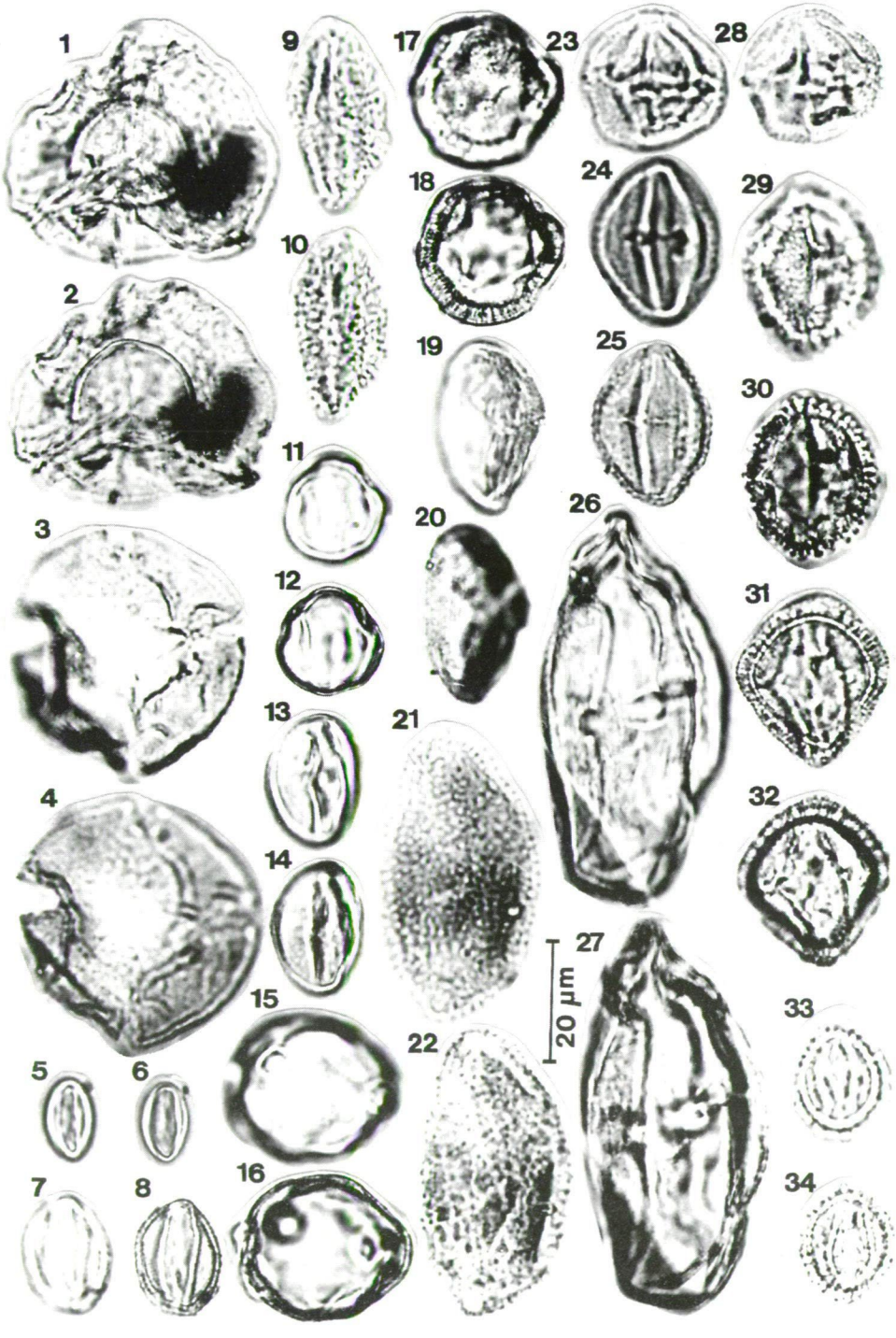
Triangulotricolporites ibericus n. fsp.
(Plate 1.2., figs. 21–26)

Diagnosis

Tricolporate pollen grains. In polar view, amb triangular, with convex sides. Surface scabrate-punctate. The exine in the inter-apertural region is 2.8–3.2 μm thick the infratectal layer is thin, intragranular. Exoapertures colpi, about 8.0–12.0 μm long, and 2.0–4.0 μm wide at the tectum. The nexine thickens in the apertural area (4.5–6.0 μm). The endanulus is about 3.5–4.0 μm thick. Endoapertures 8.0–14.0 μm long. At the poles there are triangular thickenings or thinnings. The arms of the tetrad scar-like ornamentation are oriented in the middle of the inter-apertural area.

Diameter: 20–28 μm.

Holotype: Plate 1.2., figs. 25,26, slide: 89/13–1; cross-table number: 23.6/118.9.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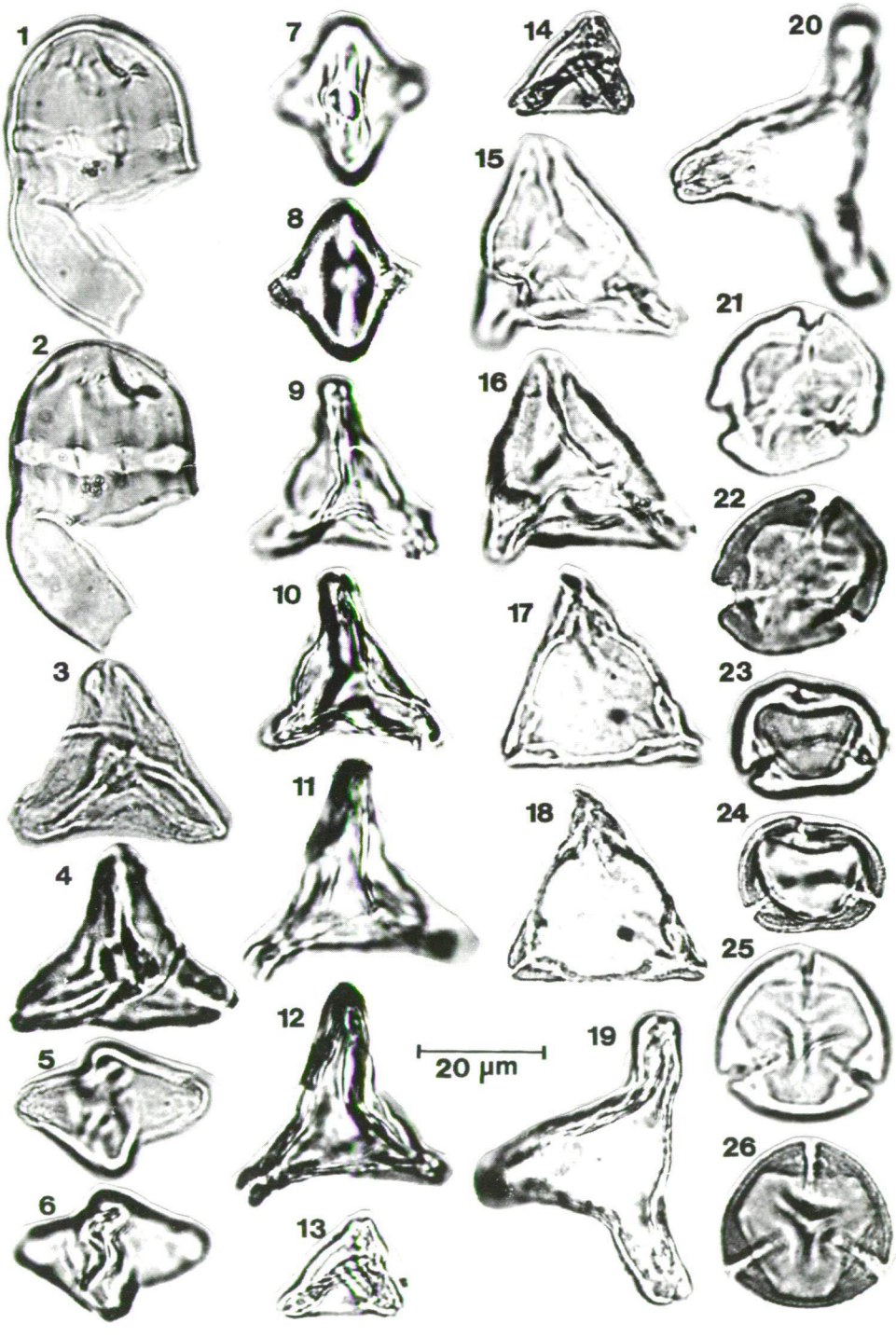
Locus typicus: Quintanilla La Ojada.
Stratum typicum: Sandy marl with limestone.
Derivatio nominis: From Iberia.
Differential diagnosis: The ornamentation of the surface and the peculiar polar ornamentation differs well from *T. triangulus* KAR 1985.
Nudopollis endangulatus (PFLUG 1953a) PFLUG 1953b (Plate 1.3., figs. 1–10),
Nudopollis minutus ZAKLINSKAYA 1963 (Plate 1.3., figs. 11,12),
Papillopollis aregulus PFLUG 1953b (Plate 1.3., figs. 13,14),
Stephanoporopollenites hexaradiatus (THIERGART 1940) THOMSON and PFLUG 1953 subfsp. *hexaradiatus* (Plate 1.3., figs. 17–20),
Stephanoporopollenites hexaradiatus (THIERGART 1940) THOMSON and PFLUG 1953 subfsp. *tribinae* KRUTZSCH 1961 (Plate 1.3., figs. 21,22),
Stephanoporopollenites hexaradiatus (THIERGART 1940) THOMSON and PFLUG 1953 subfsp. *semitribinae* KRUTZSCH 1961 (Plate 1.3., figs. 23,24),
Stephanoporopollenites pentaradiatus KRUTZSCH 1961 (Plate 1.3., figs. 25,26),
Stephanoporopollenites praehexaradiatus KRUTZSCH and LENK 1967 (Plate 1.3., figs. 27,28),
Interpollis supplingensis (PFLUG 1953a) KRUTZSCH 1961 (Plate 1.4., figs. 1–4),

Plate 1.1.

1,2. *Perotrilites* fsp., *Selaginellaceae, Selaginella,* slide: 89/1-2; cross-table number: 10.3/135.0.
3,4. *Polycolpites transdanubicus* KEDVES 1978, *Rubiaceae,* cf. *Carlemannia,* slide: 99/1-2; cross-table number: 6.6/123.1.
5,6. *Cupuliferoidaepollenites quisqualis* (POTONIÉ 1934) POTONIÉ 1960, *Fagaceae* v. *Leguminosae,* slide: 89/8-2; cross-table number: 11.9/117.1.
7,8. *Retitricolpites* fsp. A, slide: 89/1-1; cross-table number: 12.4/120.5.
9,10. *Retitricolpites* fsp. B, slide: 89/13-3; cross-table number: 21.2/129.1.
11,12. *Psilatricolporites globus* (H.DEÁK 1960) KEDVES 1978, *Sapotaceae*, slide: 99/1-2; cross-table number: 6.6/123.1.
13,14. *Cupuliferoipollenites pusillus* (POTONIÉ 1934) POTONIÉ 1960, *Fagaceae,* cf. *Castanea,* slide: 89/1-2; cross-table number: 17.1/122.6.
15,16. *Intrabaculitricolporites circulus* KEDVES 1978, slide: 89/2A-1; cross-table number: 11.4/125.2.
17,18. *Intrabaculitricolporites baculatus* (KRUTZSCH 1961) n. comb., slide: 89/2A-3; cross-table number: 14.9/136.9.
19,20. *Striatricolporites solé de portai* (KEDVES 1965a) KEDVES 1978, *Fabaceae,* slide: 99/1-2; cross-table number: 17.8/120.8.
21,22. *Retitricolporites* fsp., slide: 89/9-3;cross-table number: 11.6/135.2.
23,28. *Foveotricolporites snopkovae* KEDVES 1978, *Euphorbiaceae,* slide: 89/13-3; cross-table number: 21.8/122.8.
24,25. *Foveotricolporites gruas-cavagnettoae* KEDVES 1978, cf. *Rhamnaceae,* slide: 89/13-3; cross-table number: 17.9/126.2.
26,27. *Foveotricolporites* fsp., slide: 89/1-1; cross-table number: 16.3/132.3.
29,30. *Ilexpollenites margaritatus* (POTONIÉ 1931) THIERGART 1937 f. *medius* PFLUG and THOMSON 1953, *Aquifoliaceae, Ilex,* slide: 89/2A-3; cross-table number: 13.1/125.4.
31,32. *Ilexpollenites margaritatus* (POTONIÉ 1931) THIERGART 1937 f. *medius* PFLUG and THOMSON 1953, *Aquifoliaceae, Ilex,* slide: 89/2A-2; cross-table number: 11.9/139.6.
33,34. *Ilexpollenites margaritatus* (POTONIÉ 1931) THIERGART 1937 f. *minor, Aquifoliaceae,* slide: 89/13-3; cross-table number: 16.6/127.9.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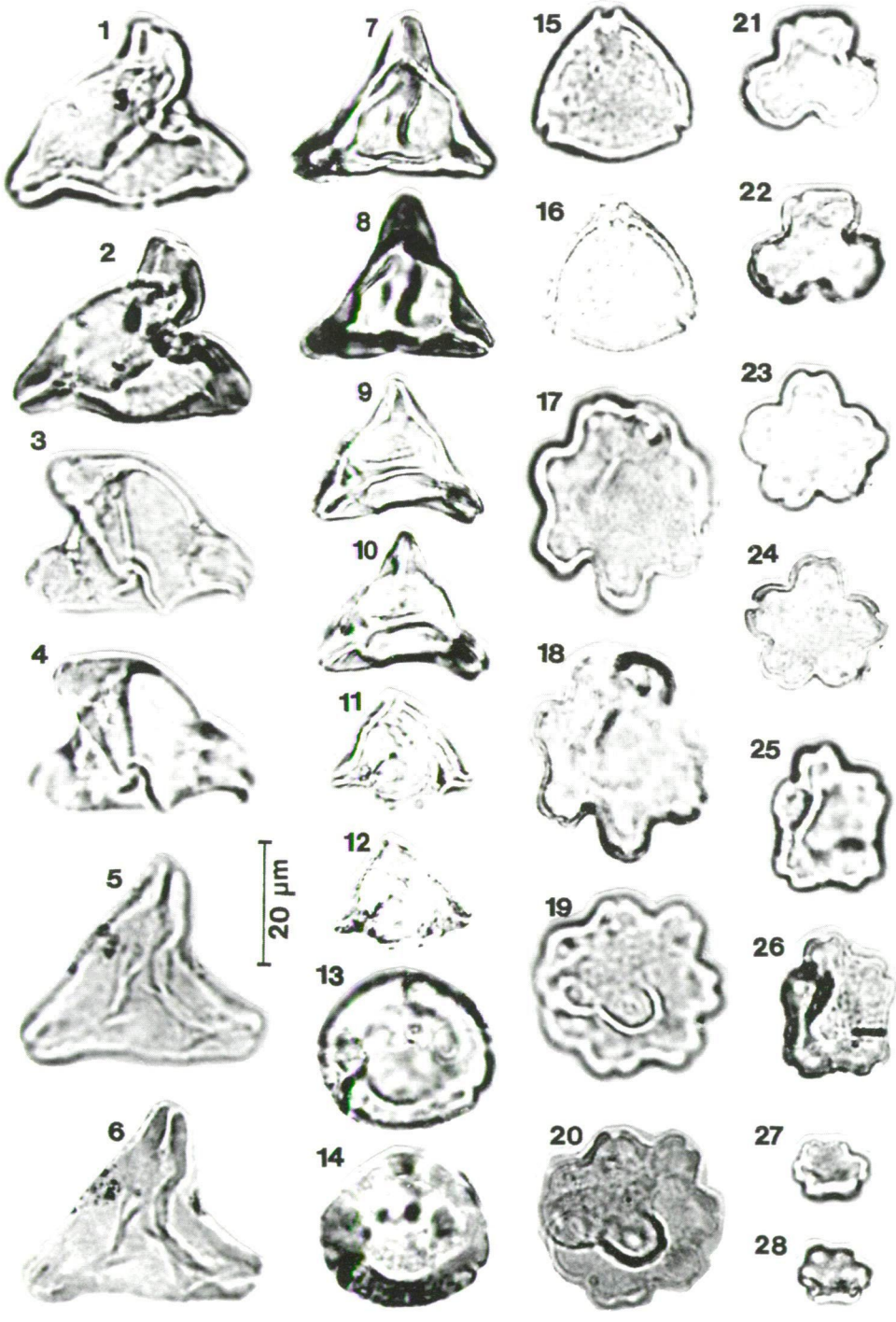
Interpollis messelensis KRUTZSCH 1961 (Plate 1.4., figs. 5,6),
Interpollis microsupplingensis KRUTZSCH 1961 (Plate 1.4., figs. 7,8),
Interpollis velum KRUTZSCH 1961 (Plate 1.4., figs. 9–16),
Vacuopollis concavus (PFLUG 1953a) KRUTZSCH 1960 in KRUTZSCH, PCHALEK and SPIEGLER (Plate 1.4., figs. 17,18),
Megatriopollis cf. *santonius* GROOT and KRUTZSCH 1967 (Plate 1.4., figs. 19,20),
Pecakipollis bohemiensis KRUTZSCH and PACLTOVÁ 1967 (Plate 1.4., figs. 23,24),
Jarzenipollenites trinus (STANLEY 1965) KEDVES 1979 (Plate 1.4., figs. 25,26),
Gallopollis fsp. (Plate 1.4., figs. 27,28),
Plicapollis pseudoexcelsus (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *semiturgidus* PFLUG 1953a, cf. *Myricaceae* (Plate 1.4., figs. 29–34),
Plicapollis pseudoexcelsus (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *turgidus* PFLUG 1953a, cf. *Myricaceae* (Plate 1.4., figs. 35–38),
Plicapollis pseudoexcelsus (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *luteticus* KEDVES 1969 cf. *Myricaceae* (Plate 1.4., figs. 39,40),
Plicapollis pseudoexcelsus (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *minor* PFLUG 1953a (Plate 1.4., figs. 41,42).

Plate 1.2.

1,2. *Tetracolporopollenites hungaricus* KEDVES 1965a, *Sapotaceae,* slide: 99/1-1; cross-table number: 18.2/148.8.
3,4. *Pentapollenites pentangulus* (PFLUG 1953a) KRUTZSCH 1958 subfsp. *crassicus* KRUTZSCH 1962, *Elaeagnaceae* v. *Simarubaceae,* slide: 89/13-2; cross-table number: 13.8/120.6.
5,6. *Pentapollenites pentangulus* (PFLUG 1953a) KRUTZSCH 1958 subfsp. *foveostriatus* KRUTZSCH 1962, *Elaeagnaceae* v. *Simarubaceae,* slide: 89/13-1; cross-table number: 11.3/128.9.
7,8. *Pentapollenites laevigatus* KRUTZSCH 1962 subfsp. *laevigatoides* KRUTZSCH 1962, *Elaeagnaceae* v. *Simarubaceae,* slide: 89/2A-3; cross-table number:14.2/127.1.
9,10. *Complexiopollis funiculus* TSCHUDY 1973, slide: 89/2A-1; cross-table number: 8.8/128.2.
11,12. *Complexiopollis funiculus* TSCHUDY 1973, slide: 89/2A-1; cross-table number: 16.8/129.2.
13,14. *Praebasopollis praebasalis* GROOT and KRUTZSCH 1967, slide: 154/1-2; cross-table number: 11.3/130.3.
15,16. *Psittacopollis elaeagnoides* (ZAKLINSKAYA 1963) KEDVES 1967, slide: 89/1-2; cross-table number: 17.5/136.8.
17,18. *Basopollis urkutensis* KEDVES 1974, slide: 99/1-1; cross-table number: 15.1/137.6.
19,20. *Basopollis basalis* (PFLUG 1953a) PFLUG 1953b, slide: 89/1-2; cross-table number: 9.3/133.1.
21,22. *Triangulotricolporites ibericus* n. fsp., slide: 89/13-3; cross-table number: 21.5/127.8.
23,24. *Triangulotricolporites ibericus* n. fsp., slide: 89/13-1; cross-table number: 11.9/124.7.
25,26. *Triangulotricolporites ibericus* n. fsp., slide: 89/13-1; cross-table number: 23.6/118.9.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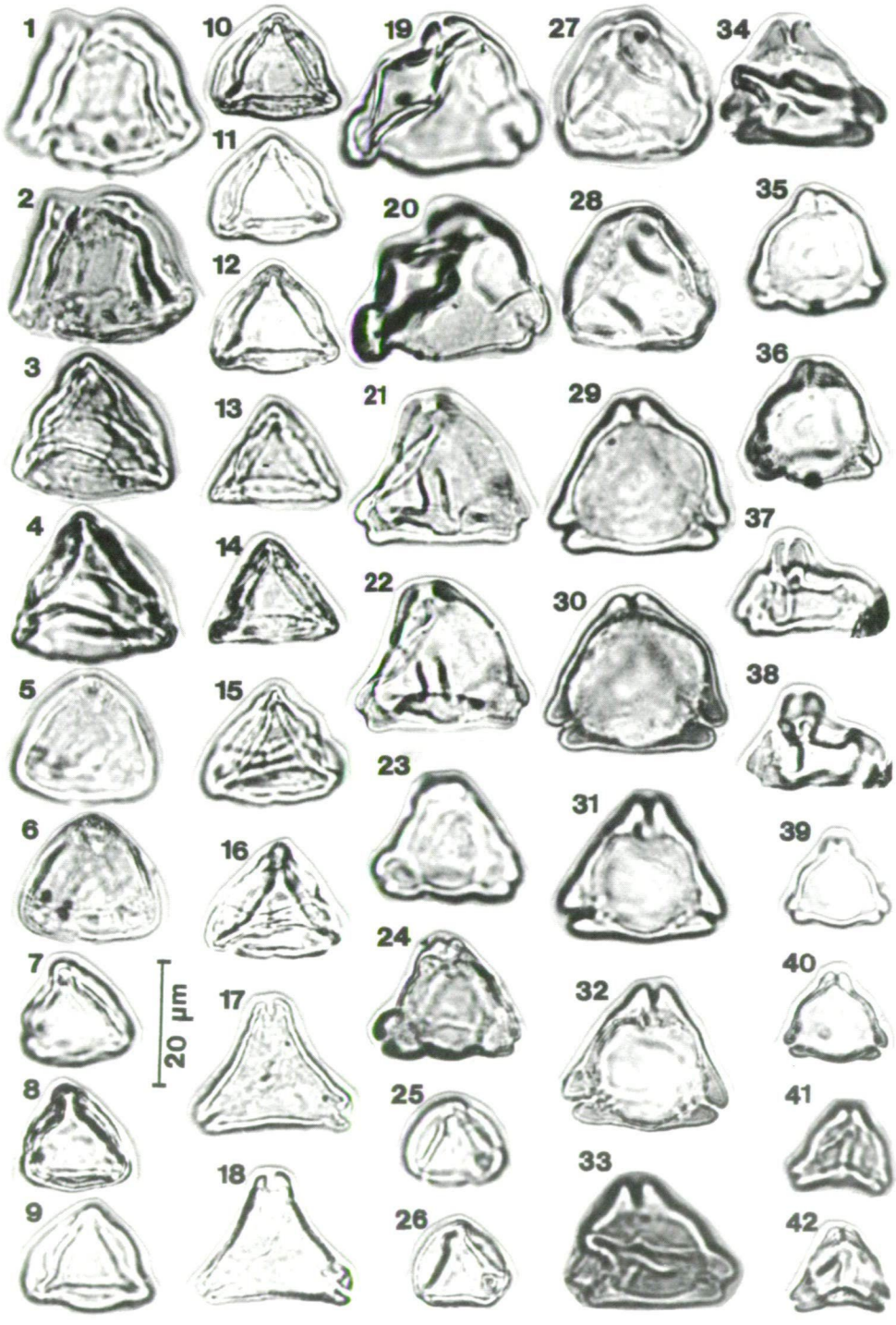
Plicapollis ibericus n. fsp.
(Plate 1.5., figs. 1–6)

Diagnosis

Triatriate, plicate pollen grains. Amb triangular, with convex sides. Inter-aperturral exine 1.5–2.0 μm thick, the infratectal layer is the thinnest between the ectexine layers. Structure intragranulate. Anulus 5.0–7.0 μm thick. Exoapertures short colpi (4.0–5.0 x 2.0–3.0 μm), endoapertures atria, intragranulate and 8.0 μm wide. Characteristic plicae are on the proximal side.
Diameter: 40.0–50.0 μm.
Holotype: Plate 1.5., figs. 5,6, slide: 89/13–2; cross-table number: 23.5/132.2.
Locus typicus: Quintanilla La Ojada.
Stratum typicum: Sandy marl with limestone.
Derivatio nominis: From Iberia.
Differential diagnosis: The relatively large size within the form-genus distincts well from the other form-species, particularly from *P. pseudoexcelsus semiturgidus.*
Caratinipollenites paleocenicus KEDVES and RUSSELL 1982 (Plate 1.5., figs .7,8).

Plate 1.3.

1,2. *Nudopollis endangulatus* (PFLUG 1953a) PFLUG 1953b, slide: 89/13-2; cross-table number: 7.7/124.2.
3,4. *Nudopollis endangulatus* (PFLUG 1953a) PFLUG 1953b, slide: 89/13-3; cross-table number: 21.8/123.2.
5,6. *Nudopollis endangulatus* (PFLUG 1953a) PFLUG 1953b, slide: 89/13-3; cross-table number: 22.0/118.5.
7,8. *Nudopollis endangulatus* (PFLUG 1953a) PFLUG 1953b, slide: 89/13-2; cross-table number: 20.6/130.1.
9,10. *Nudopollis endangulatus* (PFLUG 1953a) PFLUG 1953b, slide: 89/13-2; cross-table number: 11.5/134.1.
11,12. *Nudopollis minutus* ZAKLINSKAYA 1963, slide: 89/9-1; cross-table number: 12.4/125.8.
13,14. *Papillopollis aregulus* PFLUG 1953b, slide: 89/21-1; cross-table number:11.6/127.3.
15,16. *Triporopollenites robustus* PFLUG 1953a subfsp. *robustus,* slide: 89/13-1; cross-table number:13.1/121.9.
17,18. *Stephanoporopollenites hexaradiatus* (THIERGART 1940) THOMSON and PFLUG 1953 subfsp. *hexaradiatus,* slide: 89/13-1; cross-table number:16.9/125.8.
19,20. *Stephanoporopollenites hexaradiatus* (THIERGART 1940) THOMSON and PFLUG 1953 subfsp. *hexaradiatus,* slide: 89/13-2; cross-table number: 23.8/132.1.
21,22. *Stephanoporopollenites hexaradiatus* (THIERGART 1940) THOMSON and PFLUG 1953 subfsp. *tribinae* KRUTZSCH 1961, slide: 89/1-3; cross-table number: 7.9/128.9.
23,24. *Stephanoporopollenites hexaradiatus* (THIERGART 1940) THOMSON and PFLUG 1953 subfsp. *semitribinae* KRUTZSCH 1961, slide: 89/13-1; cross-table number: 6.1/129.1.
25,26. *Stephanoporopollenites pentaradiatus* KRUTZSCH 1961, slide: 89/13-1; cross-table number: 18.8/121.3.
27,28. *Stephanoporopollenites praehexaradiatus* KRUTZSCH and LENK 1967, slide: 89/13–1; cross-table number: 12.0/121.9.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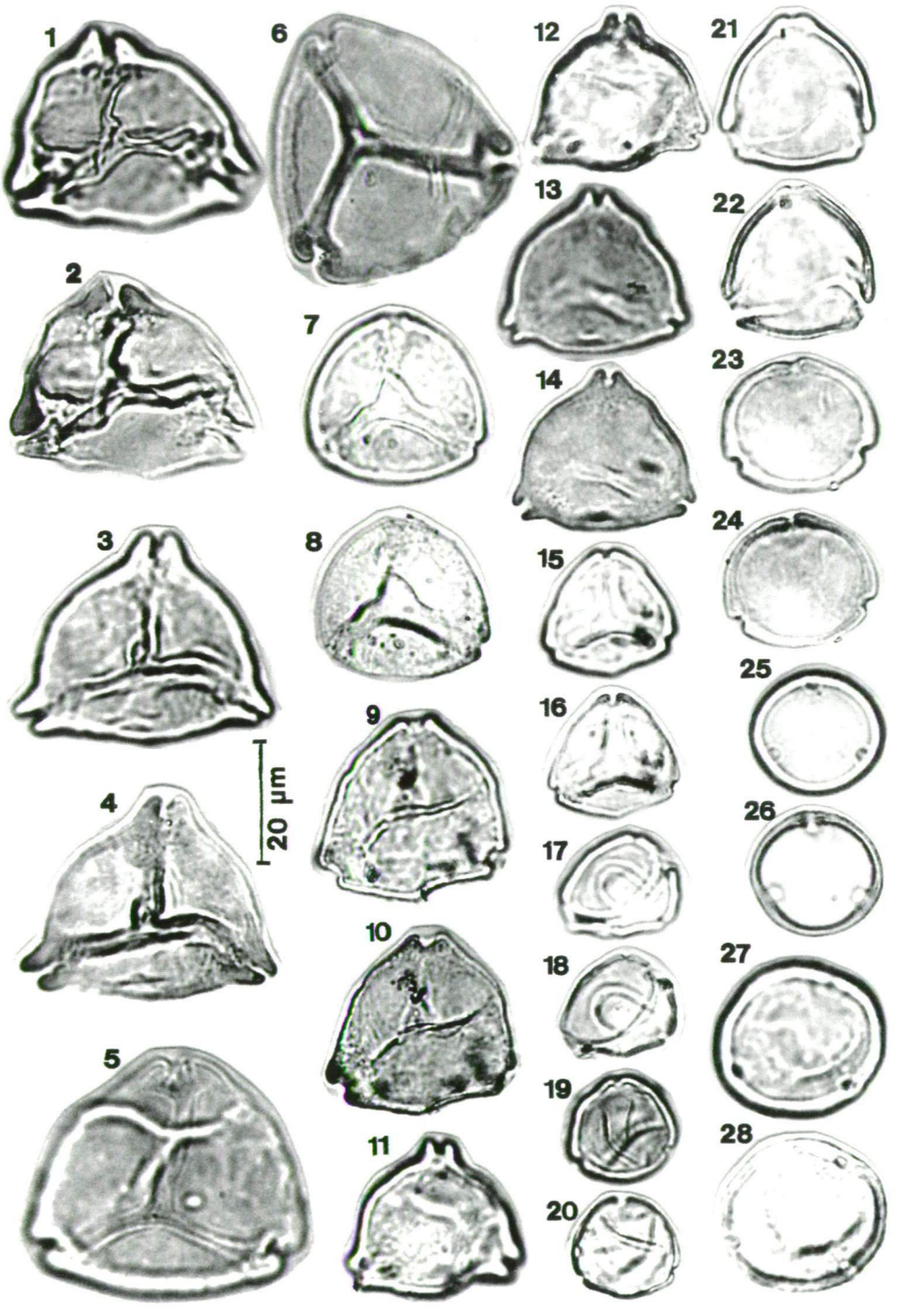
Alabroidaepollenites aroboratus (PFLUG 1953a) KEDVES and RUSSELL 1982 (Plate 1.5., figs. 9,10),
Triatriopollenites roboratus PFLUG 1953a (Plate 1.4., figs. 21,22),
Triatriopollenites takahashii KEDVES and HERNGREEN 1980 (Plate 1.5., figs. 11–14),
Plicatopollis plicatus (POTONIÉ 1934) KRUTZSCH 1962, *Juglandaceae* (Plate 1.5., figs. 15,16),
Platycaryapollenites swasticoidus (ELSIK 1974) FREDERIKSEN and CHRISTOPHER 1978, *Juglandaceae, Platycarya* (Plate 1.5., figs. 17,18),
Platycaryapollenites platycaryoides (ROCHE 1969) FREDERIKSEN and CHRISTOPHER 1978, *Juglandaceae, Platycarya* (Plate 1.5., figs. 19,20),
Triporopollenites robustus PFLUG 1953a subfsp. *robustus* (Plate 1.3., figs. 15,16),
Triporopollenites cf. *vancampoae* KEDVES 1970 (Plate 1.5., figs. 21,22),
Triporopollenites pflugii KEDVES 1974, *Juglandaceae* (Plate 1.5., figs. 23,24),

Plate 1.4.

1,2. *Interpollis supplingensis* (PFLUG 1953a) KRUTZSCH 1961, slide: 89/13-1; cross-table number: 22.6/120.4.
3,4. *Interpollis supplingensis* (PFLUG 1953a) KRUTZSCH 1961, slide: 89/13-2; cross-table number: 21.7/136.5.
5,6. *Interpollis messelensis* KRUTZSCH 1961, slide: 89/1-3; cross-table number: 5.9/133.0.
7,8. *Interpollis microsupplingensis* KRUTZSCH 1961, slide: 89/2A-2; cross-table number: 6.8/133.9.
9,10. *Interpollis velum* KRUTZSCH 1961, slide: 89/1-3; cross-table number: 12.1/132.3.
11,12. *Interpollis velum* KRUTZSCH 1961, slide: 89/1-3; cross-table number: 11.9/132.3.
13,14. *Interpollis velum* KRUTZSCH 1961, slide: 89/1-3; cross-table number: 7.5/134.7.
15,16. *Interpollis velum* KRUTZSCH 1961, slide: 89/13-1; cross-table number: 18.8/126.5.
17,18. *Vacuopollis concavus* (PFLUG 1953a) KRUTZSCH 1960 in KRUTZSCH, PCHALEK and SPIEGLER , slide: 154/1-1; cross-table number: 19.6/125.6.
19,20. *Megatriopollis* cf. *santonius* GROOT and KRUTZSCH 1967, slide: 89/1-3; cross-table number 15.2/130.6.
21,22. *Triatriopollenites roboratus* PFLUG 1953a, slide: 89/9-3; cross-table number: 24.5/137.8.
23,24. *Pecakipollis bohemiensis* KRUTZSCH and PACLTOVÁ 1967, slide: 89/2A-2; cross-table number: 6.8/133.9.
25,26. *Jarzenipollenites trinus* (STANLEY 1965) KEDVES 1979, slide: 89/1-1; cross-table number: 11.8/124.2.
27,28. *Gallopollis* fsp., slide: 89/1-3; cross-table number: 6.8/119.8.
29,30. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subsp. *semiturgidus* PFLUG 1953a, cf. *Myricaceae*, slide: 89/1-2; cross-table number: 21.7/129.1.
31,32. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *semiturgidus* PFLUG 1953a, cf. *Myricaceae*, slide: 89/1-3; cross-table number: 11.8/137.9.
33,34. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *semiturgidus* PFLUG 1953a, cf. *Myricaceae,* slide: 89/13-3; cross-table number: 19.3/122.2.
35,36. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *turgidus* PFLUG 1953a, cf. *Myricaceae,* slide: 89/1-1; cross-table number: 23.4/132.6.
37,38. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *turgidus* PFLUG 1953a, cf.Myricaceae, slide: 89/13-3; cross-table number: 11.9/123.2.
39,40. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *luteticus* KEDVES 1969, cf. *Myricaceae,* slide: 89/1-3; cross-table number: 16.4/131.6.
41,42. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *minor* PFLUG 1953a, slide: 89/13-3; cross-table number: 20.2/135.3.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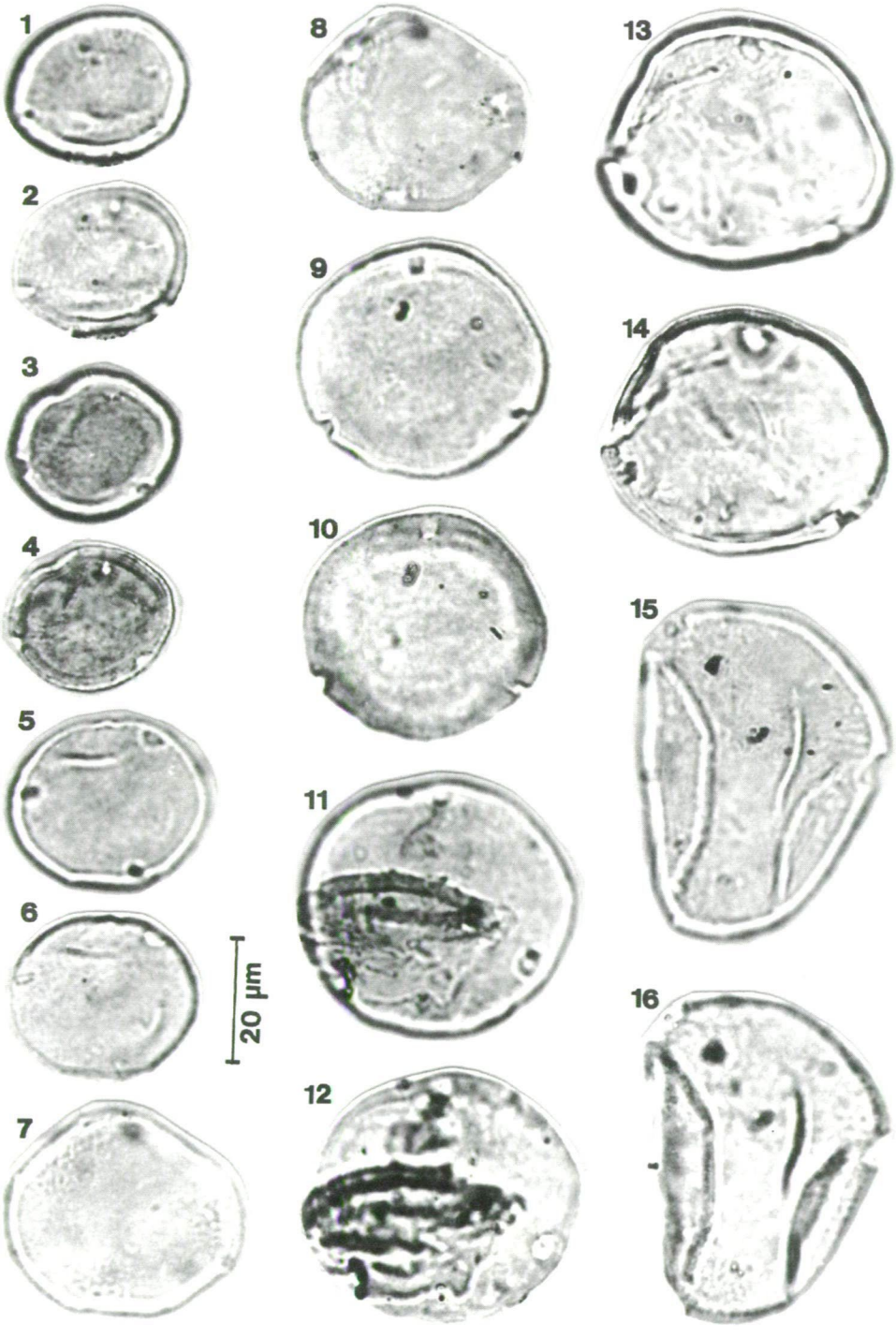
Subtriporopollenites anulatus PFLUG and THOMSON 1953 subfsp. *anulatus, Juglandaceae, Carya* (Plate 1.5., figs. 25,26),
Subtriporopollenites anulatus PFLUG and THOMSON 1953 subfsp. *nanus* PFLUG and THOMSON 1953, *Juglandaceae, Carya* (Plate 1.5., figs. 27,28),
Subtriporopollenites constans PFLUG 1953a subfsp. *constans, Juglandaceae* (Plate 1.6., figs. 1–4),
Subtriporopollenites constans PFLUG 1953a subfsp. *magnus* KRUTZSCH 1961 (Plate 1.6., figs. 5,6),
Subtriporopollenites subporatus KRUTZSCH 1961 subfsp. *subporatus* (Plate 1.6., figs. 7,8),
Subtriporopollenites subporatus KRUTZSCH 1961 subfsp. *gracillimus* KRUTZSCH and VANHOORNE 1977 (Plate 1.6., figs. 9–12),
Subtriporopollenites magnoporatus (THOMSON and PFLUG 1953) KRUTZSCH 1961 subfsp. *baculatus* KRUTZSCH and VANHOORNE 1977 (Plate 1.6., figs. 13–16, plate 1.7., figs. 1–4),
Compositoipollenites rizophorus (POTONIÉ 1934) POTONIÉ 1960 subfsp. *burghasungensis* MÜRRIGER and PFLUG 1953, *Icacinaceae* (Plate 1.7., figs. 5,6),
Intratriporopollenites fsp., *Tiliaceae* (Plate 1.7., figs. 7,8),
Symplocospollenites rotundus (POTONIÉ 1931) POTONIÉ, THOMSON and THIERGART 1950, *Symplocaceae* (Plate 1.7., figs. 9,10),

Plate 1.5.

1,2. *Plicapollis ibericus* n. fsp., slide: 89/13-1; cross-table number: 13.5/119.4.
3,4. *Plicapollis ibericus* n. fsp., slide: 89/13-3; cross-table number: 24.3/129.4.
5,6. *Plicapollis ibericus* n. fsp., slide: 89/13–2; cross-table number: 23.5/132.2.
7,8. *Caratinipollenites paleocenicus* KEDVES and RUSSELL 1982, slide: 89/1-2; cross-table number: 25.3/123.2.
9,10. *Alabroidaepollenites aroboratus* (PFLUG 1953a) KEDVES and RUSSELL 1982, slide: 89/2A-3; cross-table number: 10.2/134.6.
11,12. *Triatriopollenites takahashii* KEDVES and HERNGREEN 1980, slide: 89/1-3; cross-table number: 22.9/136.5.
13,14. *Triatriopollenites takahashii* KEDVES and HERNGREEN 1980, slide: 89/13-1; cross-table number: 23.8/121.8.
15,16. *Plicatopollis plicatus* (POTONIÉ 1934) KRUTZSCH 1962, *Juglandaceae*, slide: 89/1-3; cross-table number: 16.2/134.5.
17,18. *Platycaryapollenites swasticoidus* (ELSIK 1974) FREDERIKSEN and CHRISTOPHER 1978, *Juglandaceae, Platycarya,* slide: 89/1–1; cross-table number: 6.1/132.3.
19,20. *Platycaryapollenites platycaryoides* (ROCHE 1969) FREDERIKSEN and CHRISTOPHER 1978, *Juglandaceae, Platycarya,* slide: 89/2A–3; cross-table number: 9.8/124.3.
21,22. *Triporopollenites* cf. *vancampoae* KEDVES 1970, slide: 154/1–1; cross-table number: 19.6/125.6.
23,24. *Triporopollenites pflugii* KEDVES 1974, *Juglandaceae,* slide: 99/1–3; cross-table number: 18.3/132.1.
25,26. *Subtriporopollenites anulatus* PFLUG and THOMSON 1953 subfsp. *anulatus, Juglandaceae, Carya,* slide: 89/1–1; cross-table number: 11.2/132.1.
27,28. *Subtriporopollenites anulatus* PFLUG and THOMSON 1953 subfsp. *nanus* PFLUG and THOMSON 1953, *Juglandaceae, Carya,* slide: 89/13–2; cross-table number: 8.1/132.6.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Retistephanoporites krutzschii n. fsp.
(Plate 1.7., figs. 11–16, 21,22)

Diagnosis

In polar view amb pentangular with straight, convex or occasionally concave sides. Surface finely reticulate, the mesh of the reticulate ornamentation is about 0.5–0.9 μm. The exine is 1.6–2.0 μm thick in the inter-apertural area. The thickness of the ectexine layers is identical. Infratectal layer finely columellar. The disposition of the apertures is equatorial. The diameter of the protruding exopores is 2.5–3.5 μm, the endoapertures are larger; 3.0–5.5 μm. There are endanuli around the endopores of about 2 μm thickness.

Diameter: 34.0–48.0 μm.

Holotype: Plate 1.7., figs. 13,14, slide: 89/1–3; cross-table number: 21.2/137.1.

Locus typicus: Quintanilla La Ojada.

Derivatio nominis: In honour of Prof. Dr. W. KRUTZSCH excellent investigator of the fossil sporomorphs.

Differential diagnosis: The form-genus was originally described by GONZÁLEZ GUZMÁN (1967) as monotypic, from Lower Eocene of Columbia. The described new form-species differ from *R. angelicus* GONZÁLEZ GUZMÁN 1967 by its larger size, by the number of apertures, by the pentangular amb, and the finer reticulate ornamentation.

Reevesiapollis eocaenicus KRUTZSCH 1970, *Sterculiaceae* (Plate 1.7., figs. 17–20),

Parsonidites fsp., *?Apocynaceae* (Plate 1.8., figs. 1,2),

Striaperipollis gracillistriatus KRUTZSCH 1966, *Polemoniaceae* (Plate 1.8., figs. 3–6),

Restioniidites hungaricus (KEDVES 1965b) ELSIK 1968, *Restionaceae* (Plate 1.8., figs. 7–14),

Milfordia incerta (THOMSON and PFLUG 1953) KRUTZSCH 1961, *Restionaceae* (Plate 1.8., figs. 15,16),

Plate 1.6.

1,2. *Subtriporopollenites constans* PFLUG 1953a subfsp. *constans, Juglandaceae,* slide: 89/13–3; cross-table number: 7.3/131.9.

3,4. *Subtriporopollenites constans* PFLUG 1953a subfsp. *constans, Juglandaceae,* slide: 89/13–2; cross-table number: 14.8/134.2.

5,6. *Subtriporopollenites constans* PFLUG 1953a subfsp. *magnus* KRUTZSCH 1961, slide: 89/13–2; cross-table number: 7.2/127.8.

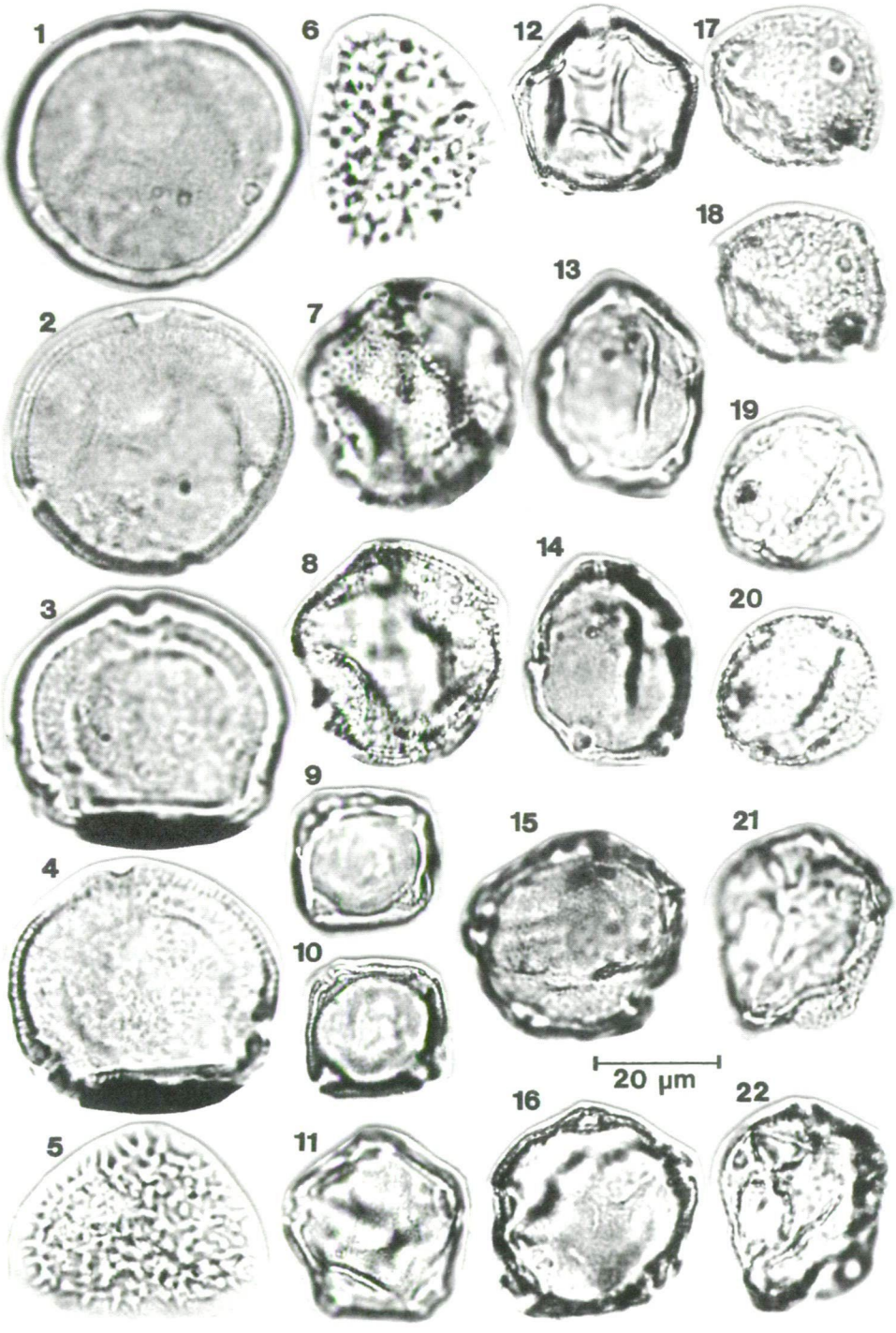
7,8. *Subtriporopollenites subporatus* KRUTZSCH 1961 subfsp. *subporatus,* slide: 89/13–3; cross-table number: 7.5/131.3.

9,10. *Subtriporopollenites subporatus* KRUTZSCH 1961 subfsp. *gracillimus* KRUTZSCH and VANHOORNE 1977, slide: 89/13–1; cross-table number: 16.2/131.7.

11,12. *Subtriporopollenites subporatus* KRUTZSCH 1961 subfsp. *gracillimus* KRUTZSCH and VANHOORNE 1977, slide: 89/13–2; cross-table number: 7.3/131.9.

13,14. *Subtriporopollenites magnoporatus* (THOMSON and PFLUG 1953) KRUTZSCH 1961 subfsp. *baculatus* KRUTZSCH and VANHOORNE 1977, slide: 89/13–1; cross-table number: 9.3/124.3.

15,16. *Subtriporopollenites magnoporatus* (THOMSON and PFLUG 1953) KRUTZSCH 1961 subfsp. *baculatus* KRUTZSCH and VANHOORNE 1977, slide: 89/13–3; cross-table number: 22.7/129.3.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Ericipites longisulcatus WODEHOUSE 1933, *Ericaceae* (Plate 1.8., figs. 17,18), *Ericipites crassiexinus* HARRIS 1972, *Ericaceae* (Plate 1.8., figs. 19,20).

QUANTITATIVE DATA

As general statement the following can be pointed out:

1. The entire absence of the *gymnosperm* pollen grains.
2. The extremely sporadic occurrence of the spores with a relatively rare type of *Selaginellaceae* in the Upper Cretaceous and Paleogene sediments.

Regarding the stratigraphical range of the samples investigated, the system of MARTINS (1988) was followed. The faunistical data of the different zone also come from the work of MARTINS (1988).

UPPER SANTONIAN – LOWER CAMPANIAN

Zone B, with *Neocrioceras riosi.*

Sample, No 154/1. – Rich in *Dinoflagellatae* cysts, poor in sporomorphs (*Praebasopollis praebasalis*, cf. *Complexiopollis* fsp., *Vacuopollis concavus, Triporopollenites* cf. *vancampoae*). At this sample the detailed taxonomical elaboration of the *Dinoflagellatae* cysts can contribute to the biostratigraphy of this zone.

Sample, No 154/5. – Extremely poor in organic remnants. Some debris of planctonic organisms were observed only.

Sample, No 144/12. – Similarly to the previous one poor in organic remnants. *Hystrichosphaeridae* cysts occur sporadically.

Plate 1.7.

1,2. *Subtriporopollenites magnoporatus* (THOMSON and PFLUG 1953) KRUTZSCH 1961 subfsp. *baculatus* KRUTZSCH and VANHOORNE 1977, slide: 89/13–1; cross-table number: 24.6/129.3.

3,4. *Subtriporopollenites magnoporatus* (THOMSON and PFLUG 1953) KRUTZSCH 1961 subfsp. *baculatus* KRUTZSCH and VANHOORNE 1977, slide: 89/13–2; cross-table number: 10.3/138.9.

5,6. *Compositoipollenites rizophorus* (POTONIÉ 1934) POTONIÉ 1960 subfsp. *burghasungensis* MÜRRIGER and PFLUG 1953, *Icacinaceae,* slide: 89/13–3; cross-table number: 13.3/130.1.

7,8. *Intratriporopollenites* fsp., *Tiliaceae,* slide: 89/2A–3; cross-table number: 22.2/129.9.

9,10. *Symplocospollenites rotundus* (POTONIÉ 1931) POTONIÉ, THOMSON and THIERGART 1950, *Symplocaceae,* slide: 89/2A–2; cross-table number: 12.4/123.6.

11,12. *Retistephanoporites krutzschii* n. fsp., slide: 89/2A–3; cross-table number: 10.5/123.3.

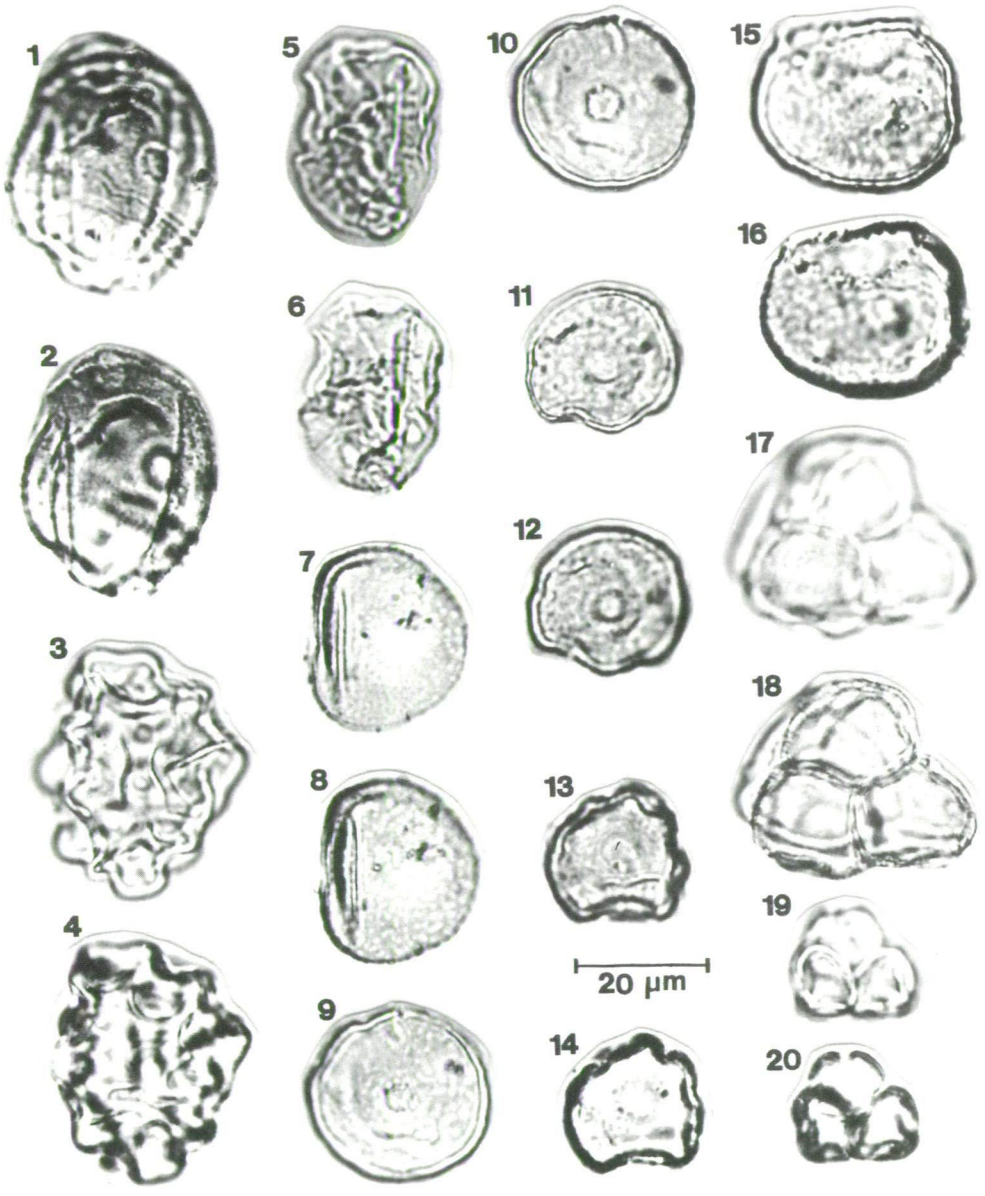
13,14. *Retistephanoporites krutzschii* n. fsp., slide: 89/1–3; cross-table number: 21.2/137.1.

15,16. *Retistephanoporites krutzschii* n. fsp., slide: 89/2A–3; cross-table number: 17.7/119.7.

17,18. *Reevesiapollis eocaenicus* KRUTZSCH 1970, *Sterculiaceae,* slide: 89/1–1; cross-table number: 7.1/125.3.

19,20. *Reevesiapollis eocaenicus* KRUTZSCH 1970, *Sterculiaceae,* slide: 89/1–1; cross-table number: 7.1/125.3.

21,22. *Retistephanoporites krutzschii* n. fsp., slide: 89/1–3; cross-table number: 11.9/121.6.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LOWER CAMPANIAN

Zone C.
Sample, No 144/1. – During our investigations organic microfossils were not observed.

MIDDLE – UPPER CAMPANIAN

Zone D.
Sample, No 144/4. – Some *Acritarch* cysts and an *Ericaceae* pollen tetrad was observed.

UPPER CAMPANIAN – LOWER MAESTRICHTIAN

Zone E.
Sample, No 89/10. – *Hystrichosphaeridae* cysts are common, without sporomorphs.
Sample, No 89/9. – *Hystrichosphaeridae* cysts are dominant, with some *angiosperm* pollen grains (*Retitricolporites* fsp., *Nudopollis minutus, Triatriopollenites roboratus*).
Sample, No 89/12. – Organic micro-remnants were not observed.

UPPER MAESTRICHTIAN – PALEOCENE

Zone F, with *Orbitoidae; Omphalocyclus macroporus, Siderolites calcitrapoides.*
Sample, No 144/6. – Some *Hystrichosphaeridae* remnant was observed only.
Sample, No 89/13. – Pollen grains of *Aquifoliaceae (Ilex)* are dominant. In view of quantity the *Myricaceae, Icacinaceae,* the caryoid types, and the pollen grains of the form-genera *Nudopollis* and *Plicapollis* are worth of mentioning. From the point of

Plate 1.8.

1,2. *Parsonidites* fsp., *?Apocynaceae,* slide: 89/2A–3; cross-table number: 18.9/130.9.
3,4. *Striaperipollis gracillistriatus* KRUTZSCH 1966, *Polemoniaceae,* slide: 89/21–2; cross-table number: 6.8/133.9.
5,6. *Striaperipollis gracillistriatus* KRUTZSCH 1966, *Polemoniaceae,* slide: 89/13–3; cross-table number: 23.6/124.6.
7,8. *Restioniidites hungaricus* (KEDVES 1965b) ELSIK 1968, *Restionaceae,* slide: 89/1–1; cross-table number: 8.1/126.2.
9,10. *Restioniidites hungaricus* (KEDVES 1965b) ELSIK 1968, *Restionaceae,* slide: 89/4–1; cross-table number: 9.6/131.7.
11,12. *Restioniidites hungaricus* (KEDVES 1965b) ELSIK 1968, *Restionaceae,* slide: 89/2A–2; cross-table number: 9.5/126.3.
13,14. *Restioniidites hungaricus* (KEDVES 1965b) ELSIK 1968, *Restionaceae,* slide: 89/2A–3; cross-table number: 12.2/129.8.
15,16. *Milfordia incerta* (THOMSON and PFLUG 1953) KRUTZSCH 1961, *Restionaceae,* slide: 89/2A–3; cross-table number: 11.4/129.2.
17,18. *Ericipites longisulcatus* WODEHOUSE 1933, *Ericaceae,* slide: 89/1–1; cross-table number: 11.8/121.6.
19,20. *Ericipites crassiexinus* HARRIS 1972, *Ericaceae,* slide: 89/1–3; cross-table number: 23.2/126.2.

view of the geological age, the occurrences of the following *angiosperm* pollen taxa are important:

Nudopollis endangulatus
Stephanoporopollenites praehexaradiatus
Stephanoporopollenites hexaradiatus hexaradiatus
Stephanoporopollenites hexaradiatus semitribinae
Stephanoporopollenites pentaradiatus
Interpollis supplingensis
Interpollis velum
Plicapollis pseudoexcelsus subfspp.
Subtriporopollenites anulatus nanus
Subtriporopollenites constans constans
Subtriporopollenites constans magnus
Subtriporopollenites subporatus subporatus
Subtriporopollenites subporatus gracillimus
Subtriporopollenites magnoporatus baculatus

Based on the above mentioned early *angiosperm* pollen grains these layers are mostly of Paleocene age. The sporadic occurrence of the *Hystrichosphaeridae* indicate more or less brackish water conditions.

Sample, No 89/8. – Very poor in organic remnants, *Myricaceae, Aquifoliaceae (Ilex)* and probably *Fagaceae* pollen grains were observed.

Sample, No 134/7. – One specimen of early caryoid pollen grain was observed only.

PALEOCENE

Zone G, with *Assilina* sp.

Sample, No 134/12. – Sporadic occurrence of some *Longaxones* and *Brevaxones angiosperm* pollen grains was observed.

Sample, No 89/2A. – The quantity of the *Aquifoliaceae (Ilex), Restionaceae,* and tricolporate pollen types is remarkable. *Hystrichosphaeridae* cysts, *Myricaceae,* and caryoid pollen types are also common. As older *Normapolles* types *Complexiopollis funiculus* and *Pecakipollis bohemiensis* are to be mentioned. By their occurrence, the following taxa are important:

Pentapollenites laevigatus laevigatoides
Interpollis microsupplingensis
Platycaryapollenites platycaryoides

Sample, No 89/1. – *Hystrichosphaeridae* cysts are dominant, with sporadic occurrence of the species of *Deflandrea.* The sample is rich in angiosperm pollen types. Pollen grains of *Myricaceae,* and the caryoid types of *Juglandaceae, Aquifoliaceae (Ilex), triporate types,* and *Plicapollis pseudoexcelsus* subfspp. are also common. The occurrence of the following taxa is important:

Psittacopollis elaeagnoides
Basopollis basalis
Stephanoporopollenites hexaradiatus tribinae
Interpollis messelensis

Interpollis velum
Megatriopollis cf. *santonius*
Jarzenipollenites trinus
Gallopollis fsp.
Caratinipollenites palaeocenicus
Platycaryapollenites swasticoidus
Subtriporopollenites anulatus anulatus
Reevesiapollenites eocaenicus
Retistephanoporites krutzschii
Restioniidites hungaricus
Ericipites fspp.

Sample, No 99/1. – The extreme dominance of the *Hystrichosphaeridae* in this sample is characteristic. The occurrence of the pollen grains is not so common. The *Aquifoliaceae (Ilex)* occurred in the highest quantity. *Restionaceae* and "caryoid types" *(Juglandaceae)* are common. The occurrence of the following form-species is worth mentioning:

Polycolpites transdanubicus
Psilatricolporites globus
Tetracolporopollenites hungaricus
Basopollis urkutensis
Triporopollenites pflugii

EOCENE

Zone H, with *Milioliidae.*

Sample, No 134/1. – Very poor in organic remnants, one *Restionaceae* pollen grain and a damaged *Nudopollis* was observed.

Discussion and Conclusions

The investigated Upper Cretaceous samples are poor in *angiosperm* pollen grains. Taking into consideration the geographical position of the localities investigated, there are several problems to solve within the *Normapolles* province of the Iberian Peninsule.

During our present investigations the occurrence of the typical Maestrichtian *Normapolles* taxa isolated from the sediments of the type locality were not observed (KEDVES and HERNGREEN 1980, HERNGREEN, FELDER, KEDVES, and MEESSEN, 1986). The *angiosperm* pollen assemblage of zone "F" is of a typically Paleocene type, with the relative richness of the "hexaradiatus" pollen type. Worth of mentioning is the earliest type within this group, the *St. praehexaradiatus.* In this way based on the occurrence of the *angiosperm* pollen grains a Monsian or Dano-Monsian age can be presumed. It is also important that the size of these *Normapolles* and early *Postnormapolles* taxa is relatively larger as general. This phenomenon was described by KRUTZSCH and VANHOORNE (1977) from the Paleocene layers of Loksbergen (Belgium). In all probability older (Upper Cretaceous) reworking is in the sample No,

89/2A. Older pollen types are present also in the sample No 89/1; *Psittacopollis elaeagnoides, Megatriopollis* cf. *santonius* and *Jarzenipollis trinus.*

Concerning the presented results it is necessary to stress again and again, that the important role of the *Ilex* genus in the Lower Paleocene vegetation is unusual. The well preserved and very characteristic Paleocene *Normapolles* taxa in sample 89/13 can be a very useful reference assemblage for this interesting and important period.

From the point of view of the second contribution of this number it is regrettable that in the investigated section we have not well preserved pollen material from the Eocene sample.

Acknowledgements

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2. SPORES AND POLLEN GRAINS FROM EOCENE LAYERS OF MÁLAGA SPAIN

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Abstract

A peculiar assemblage of spores and pollen grains was discovered in the lignite-bearing marl layers of Málaga. The general aspect of the qualitative character of this assemblage is of European type. But based on the quantitative data South American and/or African palaeophytogeographical affinity can be established. The peculiar palm pollen grains of the form-genus *Proxapertites* occur in a very high quantity in some samples, more than 40 per cent. In this paper we present the spores and the pollen grains mostly of European type, the palm, and other monosulcate pollen grains will be the subject of another paper. 3 new taxa are described herein. The spores are represented with 19 form-genera, 2 *gymnosperm* pollen genera were included herein. The representation of the *angiosperm* pollen form-genera is the following: *Longaxones* 7, *Brevaxones, Normapolles* 1, *Postnormapolles* 9.

Key words: Palynology, fossil, Eocene, Málaga, Spain.

Introduction

There are some palynological data of the Upper Cretaceous sediments of Spain. In our point of view the uppermost part is important from the locality of Barranco de la Posa (Lérida), published by DE PORTA, KEDVES, SOLÉ DE PORTA and CIVIS (1985). Paleocene palynomorphs were published from the Pyrenean Region by MÉDUS (1977). Paleocene and Lower Eocene sediments from Southern France and Northern Spain were palynologically investigated by MÉDUS (1975). A Paleogene, probably Eocene spore-pollen assemblage was published by HASELDONCKX (1973) from the Southern Pyrenees, between the Rio Esera and the Rio Segre. Lutetian palynomorphs were described by BUSQUETS, MATIAS and SOLÉ DE PORTA (1986) from the Eastern Pre-Pyrenean Chain. The remarkable presence of the pollen grains of *Pinus, haploxylon* and *diploxylon* type can be emphasized. There are some papers dealing the palynomorphs of the Bartonian sediments of Spain; ALVAREZ, BUSQUETS, SOLÉ DE PORTA and URQUIOLA (1993), BUSQUETS, ALVAREZ, SOLÉ DE PORTA and URQUIOLA, (1994) and CAVAGNETTO and ANADÓN, (1995). The importance of the bisaccate *gymnosperm* pollen grains mostly of *Pinus diploxylon* type must be

emphasized. Worth of mentioning is also the mangrove complex described by CAVAGNETTO and ANADÓN (1995).

During the combined investigations of the Harania cement factory outcrop N. SOLÉ DE PORTA discovered a very peculiar spore-pollen assemblage. Within the *angiosperm* pollen grains there are some pollen grains which were published from the Eocene sediments of Hungary. For example the interesting diporate pollen grains described first from the Eocene layers of Iszkaszentgyörgy. This was the reason for this joint research program. At this moment two papers are planned, the first one is presented herein, the second one will be in Spain, which will present and discuss among others the peculiar palm pollen grains of this locality.

Materials and Methods

Five samples were treated for palynological investigations in Barcelona and in Szeged. The LM investigations were made independently but the results were discussed and evaluated together. All samples were dark bituminous marl sediments. Numbers of the samples are as follows: 92–A–65, 92–A–66–1993, 92–A–66–1994, 92–A–68–1994, 92–A–67.

HCl, NaOH and HF was used for the treatments. The LM pictures were taken in Barcelona and in Szeged. To avoid confusion of the slides and the cross-table numbers, the pictures taken in Barcelona are marked with a "B" at the legend of the plates.

Results

QUALITATIVE DATA
SPORITES

Leiotriletes adriennis (POTONIÉ and GELLETICH 1933) KRUTZSCH 1959, *Schizaeaceae,* cf. *Lygodium* (Plate 2. 1., fig. 1),
Leiotriletes microadriennis KRUTZSCH 1959, *Schizaeaceae,* cf. *Lygodium* (Plate 2.1., figs. 2–4),
Leiotriletes maxoides KRUTZSCH 1962a subfsp. *maxoides, Schizaeaceae,* cf. *Lygodium* (Plate 2.1., fig. 5),
Leiotriletes maxoides KRUTZSCH 1962a subfsp. *maximus* (PFLUG 1953a) KRUTZSCH 1959, *Schizaeaceae,* cf. *Lygodium* (Plate 2.1., fig. 6),
Triplanosporites sinomaxoides KRUTZSCH 1962a, *Schizaeaceae,* cf. *Lygodium* (Plate 2.1., fig. 7),
Stereisporites khargaensis KEDVES 1986, *Sphagnaceae* (Plate 2.1., figs. 8,9),
Stereisporites cf. *divisistereoides* KRUTZSCH 1959, *Sphagnaceae* (Plate 2.1., fig. 10),
Cf. *Obtusisporis* fsp. (Plate 2.1., fig. 11),
Biretisporites elsikii (FREDERIKSEN 1973) KEDVES 1995 (Plate 2.1., figs. 12,13),
Biretisporites fsp. (Plate 2.1., fig. 14),
Monoleiotriletes martinelli n. fsp. (Plate 2.2., figs. 1–3),
Maculatisporites ibericus n. fsp. (Plate 2.2., figs. 4–6),
Maculatisporites eocenicus n. fsp. (Plate 2.3., figs. 1,2),

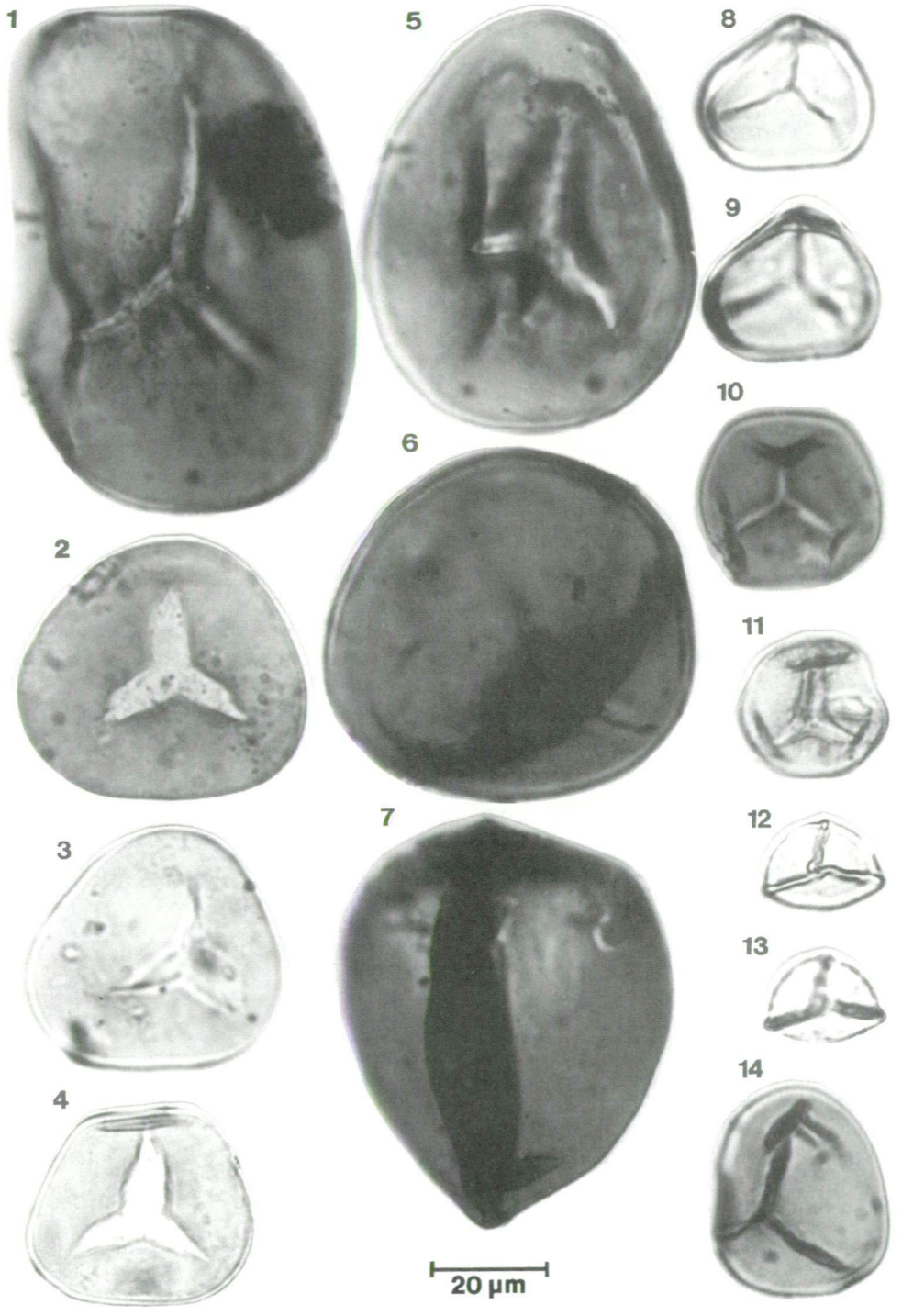
Punctatisporites micropunctus KRUTZSCH 1959 (Plate 2.3., fig. 3),
Punctatisporites luteticus KRUTZSCH 1959 (Plate 2.3., fig. 4),
Punctatisporites gelletichi KEDVES 1961 subfsp. *minor* KEDVES 1961 (Plate 2.3., fig. 5),
Cf. *Punctatisporites* fsp. (Plate 2.3., fig. 6),
Incertae A, *Monoleiotriletes* fsp., or n. fgen. (Plate 2.3., fig. 7),
Incertae B, cf. *Leiotriletes* fsp. (Plate 2.3., fig. 8),
Triremisporites delcourti DÖRING 1965, *Gleicheniaceae* (Plate 2.3., figs.9,10, plate 2.4., fig. 1),
Gleicheniidites circinidites (COOKSON 1953) BRENNER 1963, *Gleicheniaceae* (Plate 2.4., figs.2,3),
Echinatisporis fsp., *Selaginellaceae, Selaginella* (Plate 2.4., fig. 4),
Foveotriletes fsp. (Plate 2.4., fig. 5),
Cicatricosisporites cf. *triangulus* KEDVES 1973, *Schizaeaceae, ?Anemia* (Plate 2.4., fig. 6),
Cf. *Gabonisporis* fsp. (Plate 2.4., fig. 7),
Polypodiaceoisporites brevisculptatus KEDVES 1973, *Pteridaceae* (Plate 2.4., figs. 8–11),
Polypodiaceoisporites minor KEDVES 1961, *Pteridaceae* (Plate 2.4., fig. 12),
Polypodiaceoisporites bauxitus KEDVES and J. RÁKOSY 1965, *Pteridaceae* (Plate 2.4., figs. 13,14),
Polypodiaceoisporites fsp. A, *Pteridaceae* (Plate 2.4., fig. 15),
Polypodiaceoisporites fsp. B, *Pteridaceae* (Plate 2.4., fig. 16),
Cf. *Polypodiaceoisporites* fsp., *Pteridaceae* (Plate 2.4., fig. 17),
Undulozonosporites microundulus KEDVES 1974, *Pteridaceae* (Plate 2.4., figs. 18,19),
Verrucingulatisporites fsp., *Pteridaceae* (Plate 2.4., fig. 20),
Verrucatosporites saalensis KRUTZSCH 1959, *Polypodiaceae,* (Plate 2.4., fig. 21),
Reticulosporis cf. *gracilis* KRUTZSCH 1967 (Plate 2.4., fig. 22),

POLLENITES
SACCITES
DISACCITES

Cf. *Podocarpidites* fsp., *Podocarpaceae* (Plate 2.4., fig. 23),
Pityosporites labdacus (POTONIÉ 1931) THOMSON and PFLUG 1953 subfsp. *labdacus, Abietaceae, Pinus* (Plate 2.5., fig. 1),

LONGAXONES

Cupuliferoipollenites quisqualis (POTONIÉ 1934) POTONIÉ 1960, *Fagaceae* v. *Leguminosae* (Plate 2.5., fig. 2),
Cupuliferoipollenites cf. *liblarensis* (THOMSON in POTONIÉ, THOMSON and THIERGART 1950) POTONIÉ 1960, *Fagaceae* v. *Leguminosae* (Plate 2.5., fig. 3),
Polycolpites fsp. (Plate 2.5., fig. 4),
Intragranulitricolporites tumescens (KEDVES 1964) KEDVES 1978, *Calyceraceae* (Plate 2.5., figs. 5,6),
Intrabaculitricolporites porasper (PFLUG 1953a) KEDVES 1978 (Plate 2.5., fig. 7),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Retitricolporites macrodurensis (PFLUG and THOMSON 1953) ROCHE and SCHULER 1976, *Vitaceae, Cissus* (Plate 2.5., figs. 8,9),
Ilexpollenites margaritatus (POTONIÉ 1931) THIERGART 1937 f. *medius* PFLUG and THOMSON 1953, *Aquifoliaceae, Ilex* (Plate 2.5., fig. 10),
Tetracolporopollenites megadolium (POTONIÉ 1934) OLLIVIER-PIERRE 1980, *Sapotaceae* (Plate 2.5., fig.11),
Tetracolporopollenites hungaricus KEDVES 1965, *Sapotaceae* (Plate 2.5., figs. 12,13),
Tetracolporopollenites sapotoides PFLUG and THOMSON 1953, *Sapotaceae* (Plate 2.5., fig. 14),
Tetracolporopollenites obscurus PFLUG and THOMSON 1953, *Sapotaceae* (Plate 2.5., fig. 15),
Pentapollenites laevigatus KRUTZSCH 1962b subfsp. *laevigatus, Elaeagnaceae* v. *Simarubaceae* (Plate 2.5., figs. 16,17),
Pentapollenites laevigatus KRUTZSCH 1962b subfsp. *luteticus* GRUAS-CAVAGNETTO 1969, *Elaeagnaceae* v. *Simarubaceae* (Plate 2.5., figs. 18,19).

BREVAXONES
NORMAPOLLES

Plicapollis pseudoexcelsus (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *turgidus* PFLUG 1953a, cf. *Myricaceae* (Plate 2.5., figs. 24–31),
Plicapollis pseudoexcelsus (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *minor* PFLUG 1953a, cf. *Myricaceae* (Plate 2.5., figs. 32,33),

Plate 2.1.

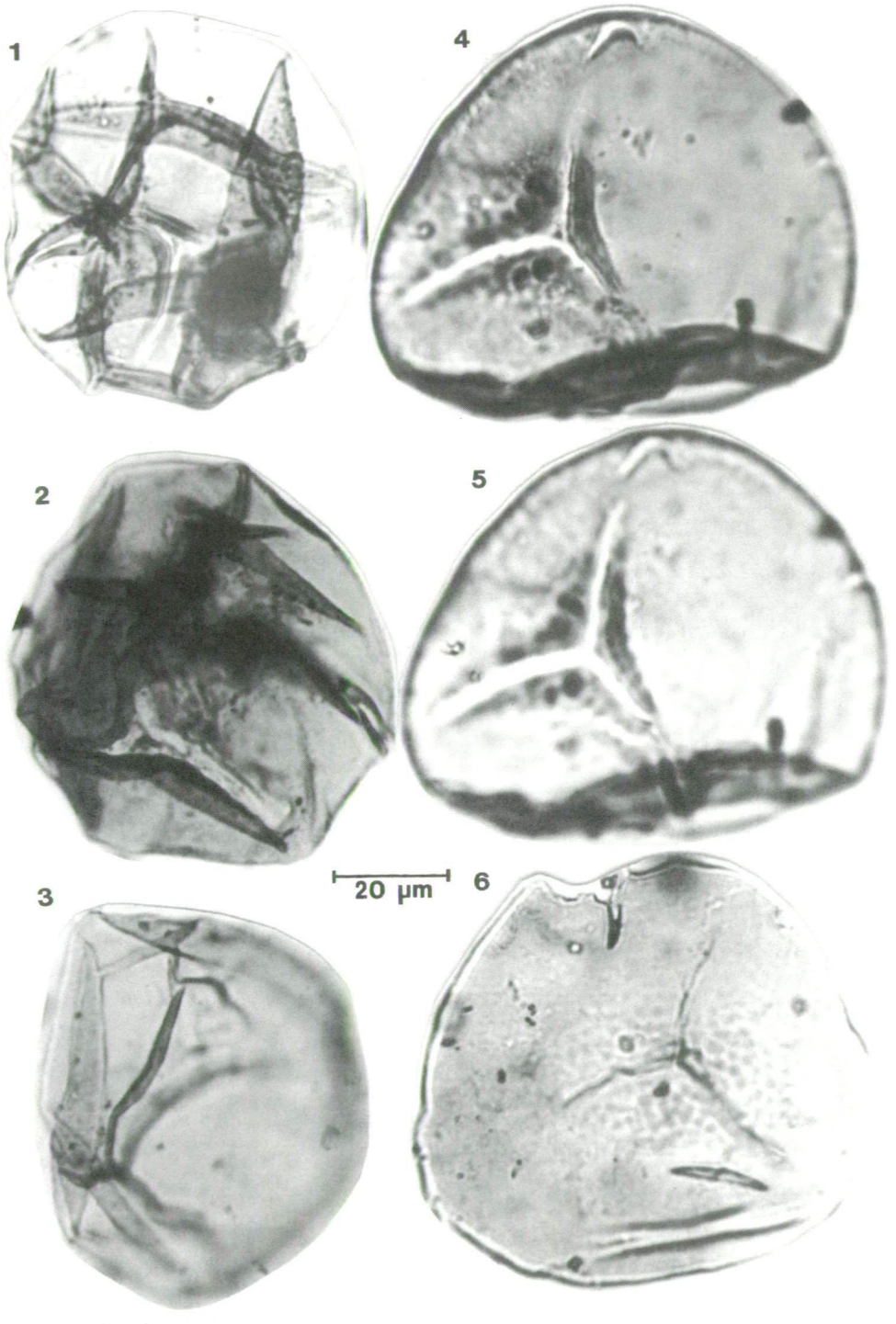
1. *Leiotriletes adriennis* (POTONIÉ and GELLETICH 1933) KRUTZSCH 1959, *Schizaeaceae,* cf. *Lygodium,* slide: B 92A–66–1; cross-table number: 50.1/103.2.
2. *Leiotriletes microadriennis* KRUTZSCH 1959, *Schizaeaceae*, cf. *Lygodium,* slide: B 92A-66-13; cross-table number: 40.8/106.7.
3. *Leiotriletes microadriennis* KRUTZSCH 1959, *Schizaeceae,* cf. *Lygodium,* slide: 92A-66-92-1; cross-table number: 10.5/139.2.
4. *Leiotriletes microadriennis* KRUTZSCH 1959, *Schizaeaceae,* cf. *Lygodium,* slide: 92A-66-93-4; cross-table number: 22.9/148.8.
5. *Leiotriletes maxoides* KRUTZSCH 1962a subfsp. *maxoides, Schizaeaceae,* cf. *Lygodium,* slide: B 92A-66-1; cross-table number: 30.0/108.0.
6. *Leiotriletes maxoides* KRUTZSCH 1962a subfsp. *maximus* (PFLUG 1953a) KRUTZSCH 1959, *Schizaeaceae,* cf. *Lygodium,* slide: B 92A-66-18; cross-table number: 43.4/107.7.
7. *Triplanosporites sinomaxoides* KRUTZSCH 1962a, *Schizaeaceae,* cf. *Lygodium,* slide: B 92A-66-2; cross-table number: 27.3/94.4.

8,9. *Stereisporites khargaensis* KEDVES 1986, *Sphagnaceae,* slide: 92A-66-93-1; cross-table number: 8.3/137.8.

10. *Stereisporites* cf. *divisistereoides* KRUTZSCH 1959, *Sphagnaceae,* slide: B 92A-66-6; cross-table number: 31.7/108.0.
11. Cf. *Obtusisporis* fsp., slide: B 92A-66-4; cross-table number:43.5/106.5.

12,13. *Biretisporites elsikii* (FREDERIKSEN 1973) KEDVES 1995, slide: 92A-68-2; cross-table number: 9.9/131.7.

14. *Biretisporites* fsp., slide: B 92A-66-15; cross-table number: 41.0/106.8.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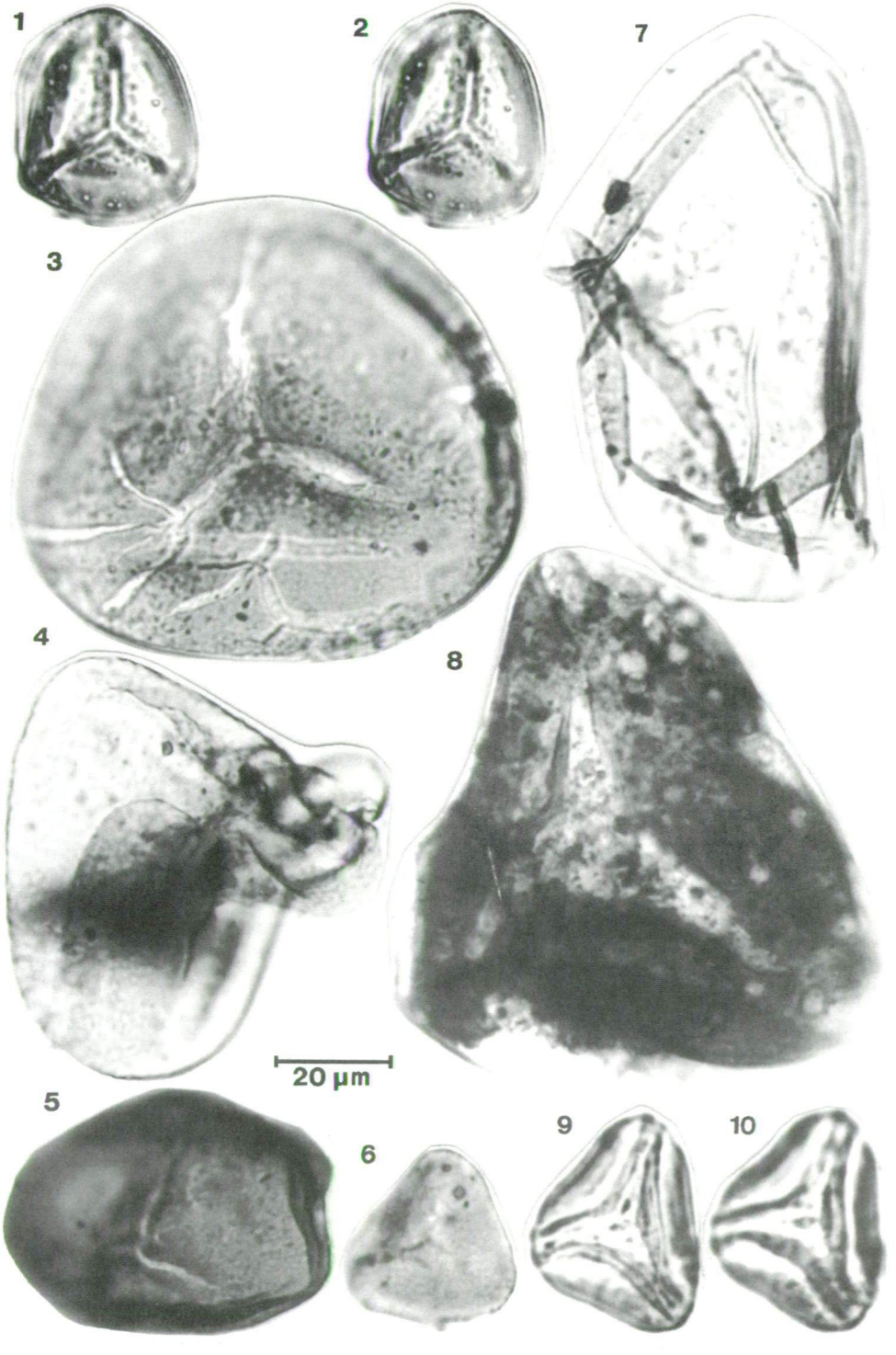
Plicapollis pseudoexcelsus (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *luteticus* KEDVES 1969, cf. *Myricaceae* (Plate 2.5., fig. 34).

POSTNORMAPOLLES

Bombacacidites fsp. A, *Bombacaceae* (Plate 2.5., figs. 20,21),
Bombacacidites fsp. B, *Bombacaceae* cf. *Ceiba* (Plate 2.5., fig. 22),
Intratriporopollenites microreticulatus MAI 1961 subfsp. *minimus* MAI 1961, *Tiliaceae* (Plate 2.5., fig. 23),
Plicatopollis cf. *plicatus* (POTONIÉ 1934) KRUTZSCH 1962c, *Juglandaceae* (Plate 2.5., figs. 35,36),
Platycaryapollenites shandongensis KE and SHI 1978, *Juglandaceae, Platycarya* (Plate 2.6., figs. 1,2),
Platycaryapollenites miocaenicus E. NAGY 1969, *Juglandaceae, Platycarya* (Plate 2.6., figs. 3,4),
Platycaryapollenites ferreri DE PORTA, KEDVES, SOLÉ DE PORTA and CIVIS 1985, *Juglandaceae, Platycarya* (Plate 2.6., figs. 5–10),
Labraferoidaepollenites intermedius (GLADKOVA 1965) *Myricaceae* (Plate 2.6., figs. 11,12),
Compositoipollenites rizophorus (POTONIÉ 1934) POTONIÉ 1960 subfsp. cf. *burghasungensis* MÜRRIGER and PFLUG 1953, *Icacinaceae* (Plate 2.6., figs. 13,14),
Compositoipollenites rizophorus (POTONIÉ 1934) POTONIÉ 1960 subfsp. cf. *burghasungensis* MÜRRIGER and PFLUG 1953, *Icacinaceae* (Plate 2.6., fig. 15),
Restioniidites minimus (KRUTZSCH 1970) KEDVES 1974, *Restionaceae* (Plate 2.6., figs. 16,17),
Triporopollenites constans TAKAHASHI 1961, *Corylaceae* (Plate 2.6., fig. 18),
Triporopollenites robustus PFLUG 1953a subfsp. *minor* KEDVES 1970, cf. *Betulaceae* (Plate 2.6., figs. 19–24),
Subtriporopollenites sympathicus (BOTSCHARNIKOVA 1960) KEDVES 1970, *Juglandaceae* (Plate 2.6., fig. 25),
Subtriporopollenites constans PFLUG 1953a subfsp. *constans, Juglandaceae* (Plate 2.6., figs. 26–32),
Subtriporopollenites constans PFLUG 1953a subfsp. *crassiexinus* KEDVES 1970 (Plate 2.6., figs. 33,34),
Subtriporopollenites subporatus KRUTZSCH 1961 subfsp. *subporatus, Juglandaceae* (Plate 2.6., figs. 35–38),

Plate 2.2.

1. *Monoleiotriletes martinelli* n. fsp., slide: B 92A-66-3; cross-table number: 48.1/112.0.
2. *Monoleiotriletes martinelli* n. fsp., slide: B 92A-66-16; cross-table number: 33.8/96.1.
3. *Monoleiotriletes martinelli* n. fsp., slide: B 92A-66-19; cross-table number: 33.7/92.7.
4,5. *Maculatisporites ibericus* n. fsp., slide: 92A-66-93-1; cross-table number: 17.8/149.2.
6. *Maculatisporites ibericus* n. fsp., slide: 92A-66-93-1; cross-table number: 9.6/139.6.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Subtriporopollenites facilis (BOTSCHARNIKOVA 1960) KEDVES 1970, *Juglandales* (Plate 2.6., figs. 39,40).

THE NEW TAXA DESCRIBED FROM THIS MATERIAL

Form-genus: *Monoleiotriletes* KRUTZSCH 1959

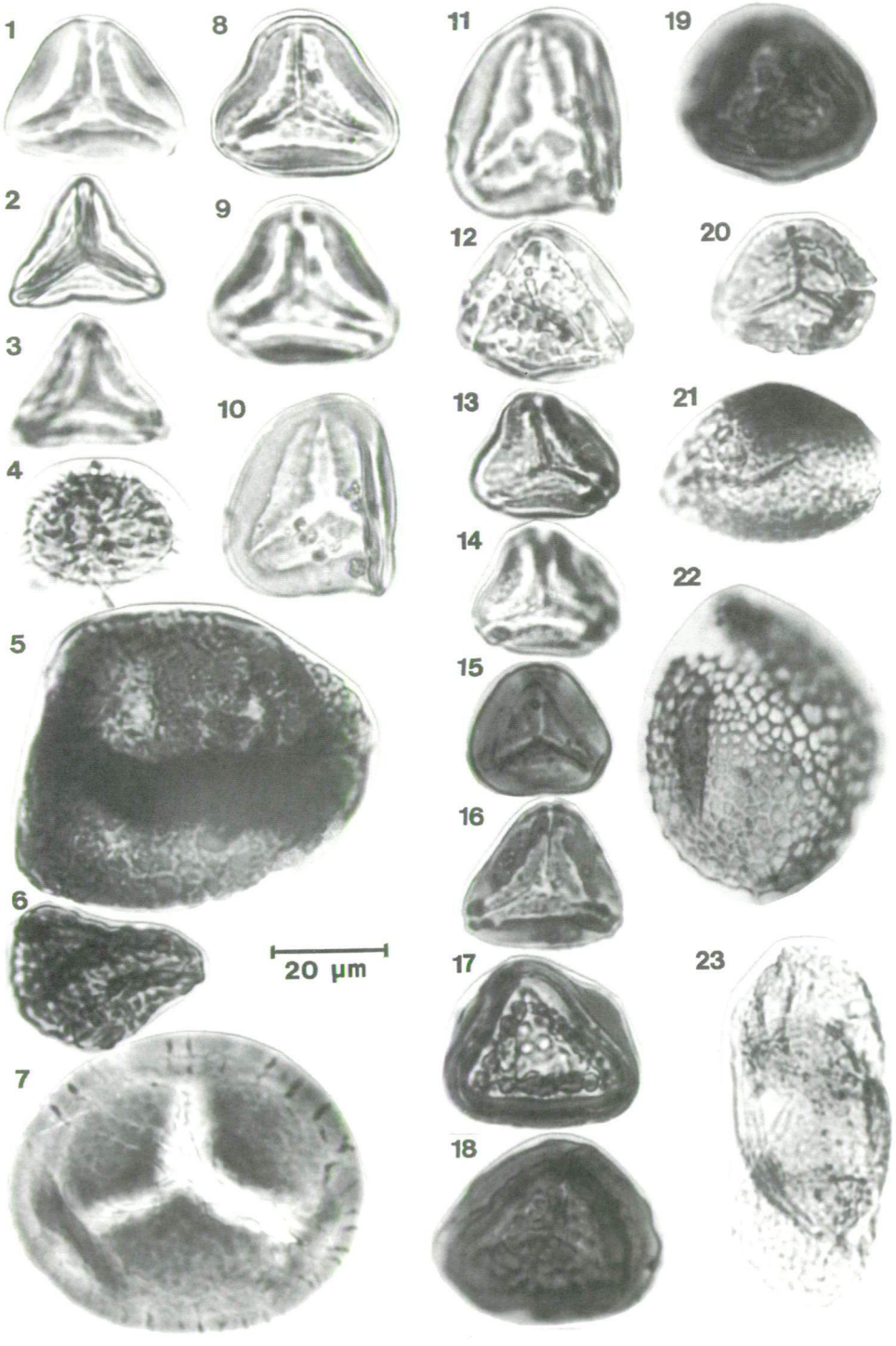
Monoleiotriletes martinelli n. fsp.
(Plate 2.2., figs. 1–3)

Diagnosis

Amb originally circular but secondarily altered with several foldings. Exospore is one layered with the LM method. The thickness of the wall is about 1–1.5 μm. Surface smooth or finely scabrate/punctate. The laesurae of the tetrad scar do not reach the equatorial contour, r = 3/4 – 4/5 approximately. Near the tetrad scar there is a torus-like thickening of 2–3.5 μm. This morphological characteristic feature may be secondary. The laesurae are often folded in the proximal pole there is a small thickening of Y shape.
Diameter: 65.0-80.0 μm.
Holotype: Plate 2.2., fig. 1, slide: B 92A-66–3; cross-table number: 48.1/112.0.
Locus typicus: Málaga.
Stratum typicum: carbonaceous marl.
Derivatio nominis: In honour of Prof. Dr. J. MARTINELL for his kind assistance in the palynological cooperations.
Differential diagnosis: Our new form-species differs from *M. angustus* KRUTZSCH 1959, by its thicker wall, with the longer laesurae and the complicated tetrad scar. The size of *Monoleiotriletes gracilis* KRUTZSCH, 1959 is below 50 μm, the *M. minimus* KRUTZSCH is smaller, about 33 μm in diameter, and the laesurae of the tetrad scar can reach the equatorial contour. *M. delmeri* ROCHE 1973 is also smaller (40–45 μm) and its laesurae are shorter (1/4–1/2) than those of the new form-species described.
Remark. – ROCHE and SCHULER (1976) published three form-species (*M. gracilis, M. angustus* and *M. minimus*) from Oligocene layers of Belgium. ROCHE (1973) described his new form-species from the Landénian from Belgium. FREDERIKSEN (1980)

Plate 2.3.

1,2. *Maculatisporites eocenicus* n. fsp., slide: 92A-66-93-1; cross-table number: 9.6/139.6.
3. *Punctatisporites micropunctus* KRUTZSCH 1959, slide: B 92A-66-5; cross-table number:42.0/103.8.
4. *Punctatisporites luteticus* KRUTZSCH 1959, slide: B 92A-67-3; cross-table number: 34.4/94.8.
5. *Punctatisporites gelletichi* KEDVES 1961 subfsp. *minor* KEDVES 1961, slide: B 92A-67-1; cross-table number: 23.8/109.4.
6. Cf. *Punctatisporites* fsp., slide: B 92A-66-20; cross-table number: 38.7/104.3.
7. Incertae A, *Monoleiotriletes* fsp. or n. fgen., slide: B 92A-66; cross-table number: 23.2/103.2.
8. Incertae B, cf. *Leiotriletes* fsp., slide: B 92A-66-8; cross-table number: 24.0/93.4.
9,10. *Triremisporites delcourti* DÖRING 1965, *Gleicheniaceae,* slide: 92A-66-93-1; cross-table number: 10.9/143.6.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published a spore (*Monoleiotriletes* sp., Plate 2, fig. 8) from the Jackson Group (Upper Eocene) of Mississippi and Western Alabama. KRUTZSCH (1959) described its species from the Lutetian layers. *M. gracilis* and *M. minimus* KRUTZSCH 1962a were published from the Paleogene layers of the Massif Armoricain (France) by OLLIVIER-PIERRE (1980).

Form-genus: *Maculatisporites* DÖRING 1964

1. *Maculatisporites ibericus* n. fsp.
(Plate 2.2., figs. 4–6)

Diagnosis

Amb triangular with convex sides. The laesurae of the tetrad scar do not reach the equator, r = 1/2–2/3. Sculpture maculate to finely granulate except the proximal pole. Around the laesurae there are larger sculptural elements, flat verrucae. The diameter of the ornamental elements is 1.5–3.5 μm. The wall of the spore is relatively thin; 1.5-2.5 μm.
Diameter: 60–80 μm.

Plate 2.4.

1. *Triremisporites delcourti* DÖRING 1965, *Gleicheniaceae,* slide: B 92A-66-8; cross-table number: 34.3/105.2.
2,3. *Gleicheniidites circinidites* (COOKSON 1953) BRENNER 1963, *Gleicheniaceae,* slide: 92A-66-94-2; cross-table number: 10.4/120.1.
4. *Echinatisporis* fsp., *Selaginellaceae, Selaginella,* slide: B 92A-68-10; cross-table number: 30.0/105.9.
5. *Foveotriletes* fsp., slide: B 92A-66-7; cross-table number: 36.3/101.4.
6. *Cicatricosisporites* cf. *triangulus* KEDVES 1973, *Schizaeaceae, ?Anemia,* slide: B 92A-66-19;cross-table number: 38.8/101.7.
7. Cf. *Gabonisporis* fsp., without perispore, slide: B 92A-66-9; cross-table number: 49.6/107.7.
8,9. *Polypodiaceoisporites brevisculptatus* KEDVES 1973, *Pteridaceae,* slide: 92A-66-93-4; cross-table number: 12.6/118.2.
10,11. *Polypodiaceoisporites brevisculptatus* KEDVES 1973, *Pteridaceae,* slide: 92A-66-93-1; cross-table number: 20.3/132.4.
12. *Polypodiaceoisporites minor* KEDVES 1961, *Pteridaceae,* slide: B 92A-67-1; cross-table number: 23.0/96.9.
13,14. *Polypodiaceoisporites bauxitus* KEDVES and J. RÁKOSY 1965,*Pteridaceae,* slide: 92A-66-93-1; cross-table number: 14.3/127.7.
15. *Polypodiaceoisporites* fsp. A, *Pteridaceae,* slide: B 92A-66-3; cross-table number: 24.0/93.3.
16. *Polypodiaceoisporites* fsp. B, *Pteridaceae,* slide: B 92A-66-7; cross-table number: 39.0/100.8.
17. Cf. *Polypodiaceoisporites* fsp., *Pteridaceae,* slide: B 92A-66-3; cross-table number: 31.3/111.5.
18. *Undulozonosporites microundulus* KEDVES 1974, *Pteridaceae,* slide: B 92A-66-10; cross-table number: 42.2/101.
19. *Undulozonosporites microundulus* KEDVES 1974, *Pteridaceae,* slide: B 92A-66-7; cross-table number: 25.5/102.2.
20. *Verrucingulatisporites* fsp., *Pteridaceae,* slide: B 92A-66-8; cross-table number: 36.5/105.3.
21. *Verrucatosporites saalensis* KRUTZSCH 1959, *Polypodiaceae,* slide: B 92A-66-9; cross-table number: 31.4/99.5.
22. *Reticulosporis* cf. *gracilis* KRUTZSCH 1967, slide: B 92A-66-16; cross-table number: 48.0/113.4.
23. Cf. *Podocarpidites* fsp., *Podocarpaceae,* slide: B 92A-68-12; cross-table number: 39.0/108.7.

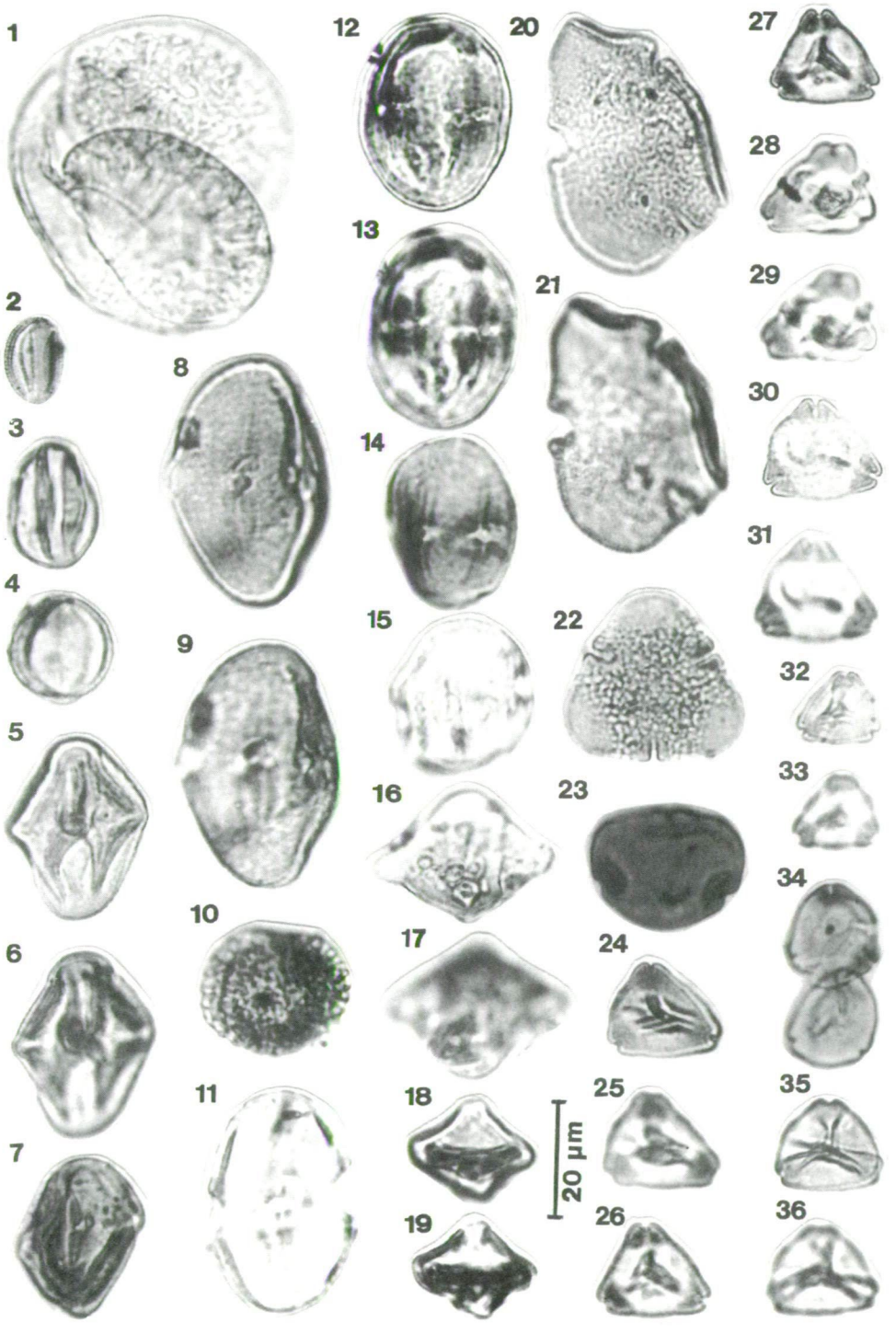
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Plate 2.5.

1. *Pityosporites labdacus* (POTONIÉ 1931) THOMSON and PFLUG 1953 subfsp. *labdacus*, *Abietaceae*, *Pinus*, slide: B 92A-68-4; cross-table number: 41.0/104.2.
2. *Cupuliferoidaepollenites quisqualis* (POTONIÉ 1934) POTONIÉ 1960, *Fagaceae* v. *Leguminosae,* slide: B 92A-67-45; cross-table number: 51.5/95.5.
3. *Cupuliferoipollenites* cf. *liblarensis* (THOMSON in POTONIÉ, THOMSON and THIERGART 1950) POTONIÉ 1960, *Fagaceae* v. *Leguminosae,* slide: B 92A-66-9; cross-table number: 31.2/96.7.
4. *Polycolpites* fsp., slide: B 92A-65; cross-table number: 30.0/94.7.

5,6. *Intragranulitricolporites tumescens* (KEDVES 1964) KEDVES 1978, *Calyceraceae,* slide: 92A-65-2; cross-table number: 16.2/123.9.

7. *Intrabaculitricolporites porasper* (PFLUG 1953a) KEDVES 1978, slide: B 92A-66-4; cross-table number: 51.2/96.9.

8,9. *Retitricolporites macrodurensis* (PFLUG and THOMSON 1953) ROCHE and SCHULER 1976, *Vitaceae, Cissus,* slide: 92A-66-93-1; cross-table number:18.4/149.3.

10. *Ilexpollenites margaritatus* (POTONIÉ 1931) THIERGART 1937 f. *medius* PFLUG and THOMSON 1953, *Aquifoliaceae, Ilex,* slide: B 92A-66-7; cross-table number: 30.0/98.4.

11. *Tetracolporopollenites megadolium* (POTONIÉ 1934) OLLIVIER-PIERRE 1980, *Sapotaceae,* slide: B 92A-67-5; cross-table number: 47.1/93.4.

12,13. *Tetracolporopollenites hungaricus* KEDVES 1965, *Sapotaceae,* slide: 92A-66-93-4; cross-table number: 17.9/139.1.

14. *Tetracolporopollenites sapotoides* PFLUG and THOMSON 1953, *Sapotaceae,* slide: B 92A-68-4; cross-table number: 31.1/94.8.

15. *Tetracolporopollenites obcurus* PFLUG and THOMSON 1953, *Sapotaceae*, slide: B 92A-68-13; cross-table number: 26.4/92.4.

16,17. *Pentapollenites laevigatus* KRUTZSCH 1962 subfsp. *laevigatus, Elaeagnaceae* v. *Simarubaceae*, slide: 92A-65-3; cross-table number: 16.2/138.3.

18,19. *Pentapollenites laevigatus* KRUTZSCH 1962 subfsp. *luteticus* GRUAS-CAVAGNETTO 1969, *Elaeagnaceae* v. *Simarubaceae*, slide: 92A-68-3; cross-table number: 15.2/137.2.

20,21. *Bombacacidites* fsp. A, *Bombacaceae*, slide: 92A-66-93-2; cross-table number: 22.2/123.8.

22. *Bombacacidites* fsp. B, *Bombacaceae*, cf. *Ceiba*, slide: B 92A-68-2; cross-table number: 45.5/92.9.

23. *Intratriporopollenites microreticulatus* MAI 1961 subfsp. *minimus* MAI 1961, *Tiliaceae*, slide: 92A-66-7; cross-table number: 26.8/105.5.

24,25. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *turgidus* PFLUG 1953a, cf. *Myricaceae*, slide: 92A-66-94-3; cross-table number: 12.2/120.3.

26,27. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *turgidus* PFLUG 1953a, cf. *Myricaceae,* slide: 92A-66-93-4; cross-table number: 12.7/133.2.

28,29. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *turgidus* PFLUG 1953a, cf. *Myricaceae*, slide: 92A-67-1; cross-table number: 20.3/146.2.

30,31. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *turgidus* PFLUG 1953a, cf. *Myricaceae*, slide: 92A-66-93-1; cross-table number: 7.7/146.3.

32,33. *Plicapollis pseudexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *minor* PFLUG 1953a, cf. *Myricaceae*, slide: 92A-66-93-1; cross-table number: 7.4/125.3.

34. *Plicapollis pseudoexcelsus* (KRUTZSCH 1958) KRUTZSCH 1961 subfsp. *luteticus* KEDVES 1969, cf. *Myricaceae*, slide: B 92A-66-9; cross-table number: 47.2/98.7.

35,36. *Plicatopollis* cf. *plicatus* (POTONIÉ 1934) KRUTZSCH 1962c, *Juglandaceae*, slide: 92A-66-93-3; cross-table number: 21.8/111.6.

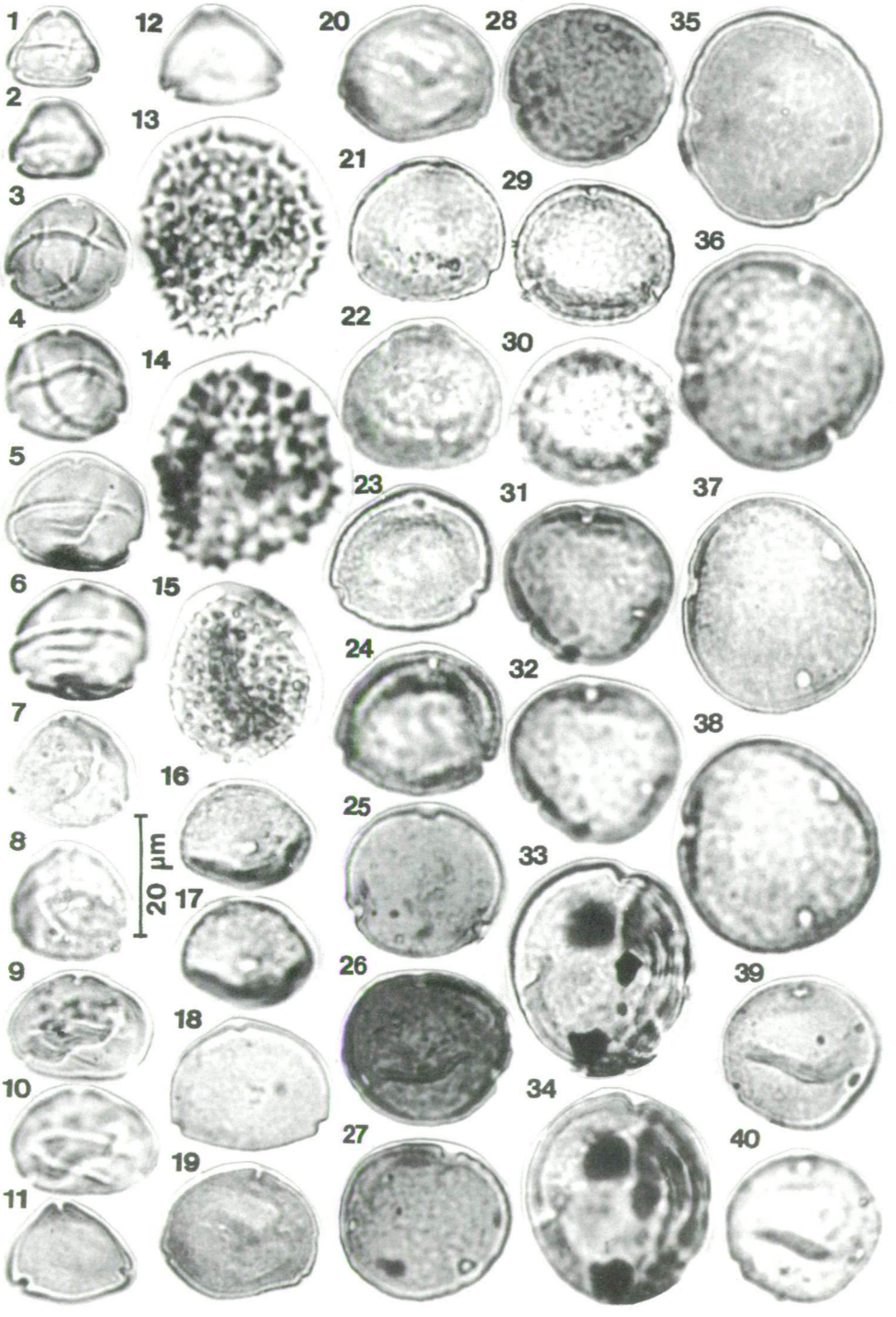
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Plate 2.6.

1,2. *Platycaryapollenites shandongensis* KE and SHI 1978, *Juglandaceae, Platycarya*, slide: 92A-68-4; cross-table number: 12.7/146.4.

3,4. *Platycaryapollenites miocaenicus* E. NAGY 1969, *Juglandaceae, Platycarya*, slide: 92A-66-93-3; cross-table number: 9.3/144.2.

5,6. *Platycaryapollenites ferreri* DE PORTA, KEDVES, SOLÉ DE PORTA and CIVIS 1985, *Juglandaceae, Platycarya*, slide: 92A-66-93-1; cross-table number: 8.1/134.2.

7,8. *Platycaryapollenites ferreri* DE PORTA, KEDVES, SOLÉ DE PORTA and CIVIS 1985, *Juglandaceae, Platycarya*, slide: 92A-65-1; cross-table number:18.2/149.8.

9,10. *Platycaryapollenites ferreri* DE PORTA, KEDVES, SOLÉ DE PORTA and CIVIS 1985, *Juglandaceae, Platycarya*, slide: 92A-67-1; cross-table number: 19.7/137.3.

11,12. *Labraferoidaepollenites intermedius* (GLADKOVA 1965) *Myricaceae*, slide: 92A-66-93-1; cross-table number: 7.9/142.5.

13,14. *Compositoipollenites rizophorus* (POTONIÉ 1934) POTONIÉ 1960 subfsp. *burghasungensis* MÜRRIGER and PFLUG 1953, *Icacinaceae*, slide: 92A-66-93-1; cross-table number: 13.3/149.2.

15. *Compositoipollenites rizophorus* (POTONIÉ 1934) POTONIÉ 1960 subfsp. cf. *burghasungensis* MÜRRIGER and PFLUG 1953, *Icacinaceae*, slide: B 92A-67-3; cross-table number:12.4/131.7.

16,17. *Restioniidites minimus* (KRUTZSCH 1970) KEDVES 1974, *Restionaceae*, slide: 92A-67-3; cross-table number:12.4/131.7.

18. *Triporopollenites constans* TAKAHASHI 1961, *Corylaceae*, slide: B 92A-66-2; cross-table number: 44.7/106.7.

19,20. *Triporopollenites robustus* PFLUG 1953a subfsp. *minor* KEDVES 1970, cf. *Betulaceae*, slide: 92A-67-4; cross-table number: 23.5/146.3.

21,22. *Triporopollenites robustus* PFLUG 1953a subfsp. *minor* KEDVES 1970, cf. *Betulaceae*, slide: 92A-65-2; cross-table number: 16.2/123.9.

23,24. *Triporopollenites robustus* PFLUG 1953a subfsp. *minor* KEDVES 1970, cf. *Betulaceae*, slide: 92A-66-93-1; cross-table number: 9.9/121.0.

25. *Subtriporopollenites sympathicus* (BOTSCHARNIKOVA 1960) KEDVES 1970, *Juglandaceae,* slide: B 92A-66-2; cross-table number: 23.9/95.5.

26. *Subtriporopollenites constans* PFLUG 1953a subfsp. *constans, Juglandaceae,* slide: B 92A-66-15; cross-table number: 37.8/99.1.

27. *Subtriporopollenites constans* PFLUG 1953a subfsp. *constans, Juglandaceae,* slide: B 92A-66-8; cross-table number: 26.0/103.1.

28. *Subtriporopollenites constans* PFLUG 1953a subfsp. *constans, Juglandaceae,* slide: B 92A-66-5; cross-table number: 25.3/106.7.

29,30. *Subtriporopollenites constans* PFLUG 1953a subfsp. *constans, Juglandaceae,* slide: B 92A-66-93-4; cross-table number: 15.2/136.2.

31,32. *Subtriporopollenites constans* PFLUG 1953a subfsp. *constans, Juglandaceae,* slide: B 92A-66-93-1; cross-table number: 10.9/138.9.

33,34. *Subtriporopollenites constans* PFLUG 1953a subfsp. *crassiexinus* KEDVES 1970, *?Juglandaceae,* slide: 92A-66-93-1; cross-table number: 24.3/115.9.

35,36. *Subtriporopollenites subporatus* KRUTZSCH 1961 subfsp. *subporatus, Juglandaceae,* slide: 92A-66-2; cross-table number: 7.7/138.2.

37,38. *Subtriporopollenites subporatus* KRUTZSCH 1961 subfsp. *subporatus, Juglandales,* slide: 92A-66-93-4; cross-table number: 6.8/120.2.

39,40. *Subtriporopollenites facilis* (BOTSCHARNIKOVA 1960) KEDVES 1970, *Juglandales,* slide: 92A-65-3; cross-table number: 18.9/149.4.

Holotype: Plate 2.2., figs. 4,5, slide: 92A–66–93–1; cross-table number: 17.8/149.2.
Locus typicus: Málaga.
Stratum typicum: carbonaceous marl.
Derivatio nominis: From Iberia.
Differential diagnosis: The characteristic polar ornamentation and the convex contour well separate from *M. maculatus* DÖRING 1964. The wall of *M. rotangulus* is much more thicker than those of our new form-species.

2. *Maculatisporites eocenicus* n. fsp.
(Plate 2.3., figs. 1,2)

Diagnosis

Amb triangular with convex sides. The laesurae are long but do not always reach the equator, r = 4/5–5/5. Around the laesurae of the tetrad scar there are thickenings of about 1.5 μm. The ornamentation of the surface is finely maculate, except the polar area. The bordering area of the narrow kyrtom is surrounded by flat verrucae-like, large granules of 0.8–1.2 μm diameter. The thickness of the wall is 1.2–1.8 μm.
Diameter: 28.0–35.0 μm.
Holotype: Plate 2.3., figs. 1,2; slide: 92A–66–93–1; cross-table number: 9.6/139.6.
Locus typicus: Málaga.
Stratum typicum: carbonaceous marl.
Derivatio nominis: From the age of the stratum typicum.
Differential diagnosis: The smaller size distinct well this new form-species from the previously described within this form-genus.

Discussion and Conclusions

As it was emphasized in the abstract and in the introduction, this paper presents one part of our results. Namely: the spores and the pollen grains, which are characteristic mostly for the European, sensu lato for the Paleogene layers of the Northern Hemisphere. Taking into consideration the bibliographical data of the Upper Cretaceous and the Paleogene sporomorphs, from the point of view of Paleophytogeography and Palynostratigraphy, the following groups can be recognized:

1. Sporomorphs, which are characteristic for the Lutetian are the following:
Leiotriletes adriennis
Punctatisporites luteticus
Polypodiaceoisporites brevisculptatus
Polypodiaceoisporites minor
Undulozonosporites microundulus
Pentapollenites laevigatus subfspp.

2. *Angiosperm* pollen grains which occur mostly in the lower part of the Middle Eocene:
Plicapollis pseudoexcelsus turgidus
Plicapollis pseudoexcelsus minor

Labraferoidaepollenites intermedius
Triporopollenites robustus minor
Subtriporopollenites sympathicus
Subtriporopollenites constans constans
Subtriporopollenites subporatus subporatus
Subtriporopollenites facilis
3. As older forms
Stereisporites khargaensis
Triremisporites delcourti and the
Platycaryapollenites ferreri can be pointed out.

4. Older, Mesozoic relict or reworked spores are the representatives of the form-genus *Maculatisporites.*

5. As younger mostly Upper Eocene and Oligocene *angiosperm* types the *Bombacaceae* pollen grains may be mentioned.

6. Paleophytogeographically the presence of the form-genera *Platycaryapollenites* and *Plicatopollis* is interesting. In the Paris Basin during the Paleogene the fossil forms of the genus *Platycarya* are important. In the Carpath Basin there are few specimens of *Platycaryapollenites* during the Paleogene, but the *Plicatopollis,* as an extinct group of the *Juglandaceae* is extremely abundant in several localities.

In resumé for the geological age on the basis of the presented data, the Middle Eocene can be established, in all probability, the lower part of the Middle Eocene.

Acknowledgements

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3. NEW DATA CONCERNING THE SOLUBILITY OF THE POLLEN GRAINS OF THE GENUS QUERCUS L.

Short communication

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A long time ago, it was established, that the solubility and the resistance of the different components of the sporopollenin is the base of investigation of the organization and symmetry of the different levels of the biopolymer structures (cf. SOUTHWORTH, 1986, ROWLEY and PRIJANTO, 1977, etc.). In our laboratory several kinds of partial degradation experiments were carried out. Different solvents and/or different oxidizing agents were used for the partial degradation. The investigations were made with the LM and the TEM method. During our experiment series (KEDVES and GÁSPÁR, 1994) we investigated the solubility of the sporoderm of the species as follows: *Ustilago maydis, Equisetum arvense, Encephalartos ferox, Pinus griffithii, Quercus robur* and *Juglans major.* Two solvents (diethylamine and merkaptoethanol) were used. Among the first results the most surprising one was the unexpected solubility of the exines of the pollen grains of *Quercus robur.* Diethylamine after 30 days dissolved near entirely the external part of the pollen wall. In contrast to this, the peculiar, strong resistance of the exine of *Juglans major* may be pointed out. It was self evident, that in the case of the genus *Quercus* it is necessary or near obligatory to accomplish controlling experiments. These investigations were made during this spring (1995). The experimental material was collected by I. GÁSPÁR. Pollen grains of *Quercus robur* were collected from four localities: F–1, F–2, from the Botanical Garden of the J. A. University, U–1, U–2, from the Park of Ujszeged. Further species *(Q. libani, Q. pubescens, Q. cerris)* from the Botanical Garden of the J. A. University.

The data of the collections and the experiments are the following:

Q. robur F–1, collected on 24.04.1995, experiments No: 1/7 – 97 (diethylamine), 1/7 - 98 (merkaptoethanol), F-2, collected on 24.04.1995, experiments No: 1/7 - 100 (diethylamine), 1/7 – 101 (merkaptoethanol), U-l, collected on 27.04.1995, experiments No: 1/7 – 103 (diethylamine), 1/7 – 104 (merkaptoethanol), U–2, collected on 27. 04. 1995, experiments No: 1/7 – 106 (diethylamine), 1/7 – 107 (merkaptoethanol).

Q. libani, collected on 26. 04. 1995, experiments No: 1/7 – 94 (diethylamine), 1/7 – 95 (merkaptoethanol).

Q. pubescens, collected on 26. 04. 1995, experiments No: 1/7 – 109 (diethylamine), 1/7 - 110 (merkaptoethanol).

Q. cerris, collected on 24. 04. 1995, experiments No: 1/7 – 112 (diethylamine), 1/7 – 113 (merkaptoethanol).

Temperature: 30 °C, length of time 30 days, from 28. 04. 1995. 5 mg pollen material + 5 ml H_2O + 0.2 ml solvent.

Results

Quercus robur L. (Plate 3.1., figs. 1-12, plate 3.2., figs. 1,2).

Experiment No: 1/7 – 97 (Plate 3.2., figs. 1,2). – The external part of the exine was not completely dissolved, the protoplasm is separated from the ectexine.

Experiment No: 1/7 – 98 (Plate 3.2., figs. 3,4). – Different kinds of alterations were observed, in consequence of the different degrees of the contraction of the protoplasm. The exine is not completely dissolved.

Experiment No: 1/7 – 100 (Plate 3.1., figs. 5,6). – So-called "hiatus forms" were also observed, the protoplasm is secondarily granular.

Experiment No: 1/7 – 101 (Plate 3.1., fig. 7). – The alteration is similar as the type illustrated in fig. 4, Plate 3.1.

Experiment No: 1/7 – 103 (Plate 3.1., figs. 8,9). – The alteration is essentially identical to the experiment No: 1/7 – 100.

Experiment No: 1/7 – 104, (Plate 3.1., fig. 10). – This result is identical to the previous one; figs. 4,7, Plate 3.1.

Experiment No: 1/7 – 106 (Plate 3.1., figs. 11,12). – This result is identical to the first one, illustrated in figs. 1,2, Plate 3.1.

Experiment No: 1/7 – 107 (Plate 3.2., figs. 1,2). – The alteration is similar as the experiment 1/7 – 98 illustrated in Plate 3.1., fig. 3.

Quercus libani OLIVER

Experiment No: 1/7 – 94 (Plate 3.2., figs. 3,4). – The result is more or less identical to the first one, cf. figs. 1,2, in Plate 3.1.

Experiment No: 1/7 – 95 (Plate 3.2., figs. 5,6). – The result is identical to those illustrated in the Plate 3.2., figs. 1,2.

Quercus pubescens MILLD.

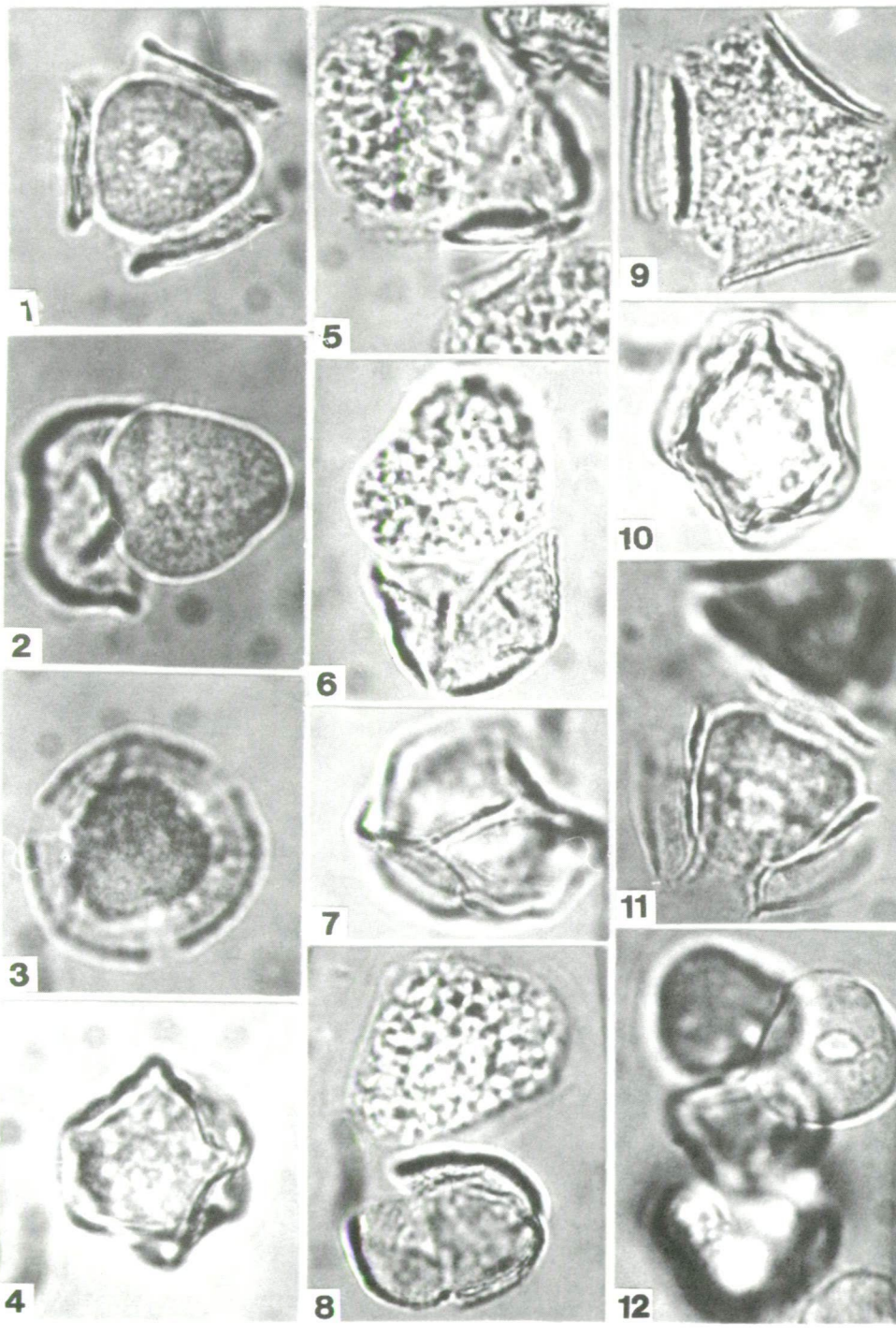
Experiment No: 1/7 – 109 (Plate 3.2., figs. 7-9). – The two kinds of alterations were observed as at the experiment No: 1/7 – 98 (Plate 3.1., figs. 3,4).

Experiment No: 1/7 – 110 (Plate 3.2., fig. 10). – The solvent effect is identical to the specimen illustrated in fig. 4, Plate 3.1.

Quercus cerris L.

Experiment No: 1/7 – 112 (Plate 3.2., fig. 11). – The solvent effect is identical to those of *Q. libani* (Plate 3.2., fig. 3).

Experiment No: 1/7 – 113 (Plate 3.2., fig. 12). – The result of this experiment is identical to those illustrated in fig. 4, Plate 3.1.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On the basis of the present day results, we can conclud the following:

1. The peculiar weak resistance of the exine of the genus *Quercus* was demonstrated by the repeated experiments.
2. Regarding the details, the dissolution of the ectexine with diethylamine was not so complete as during our first, and published experiments (cf. KEDVES and GÁSPÁR, 1994).
3. Differences were observed in the fine details of the measure of the dissolution of diethylamine within the species (*Q. robur*), specimens collected from different localities.
4. Similarities and differences were observed between the different species of the genus *Quercus*.
5. The dissolution of the exines with merkaptoethanol was relatively unanimous.
6. Finally, these new data verifyed again the extreme complexity and multifactorial character of the sporopollenin.

This work was supported by the Grant OTKA 1/7, T 014692.

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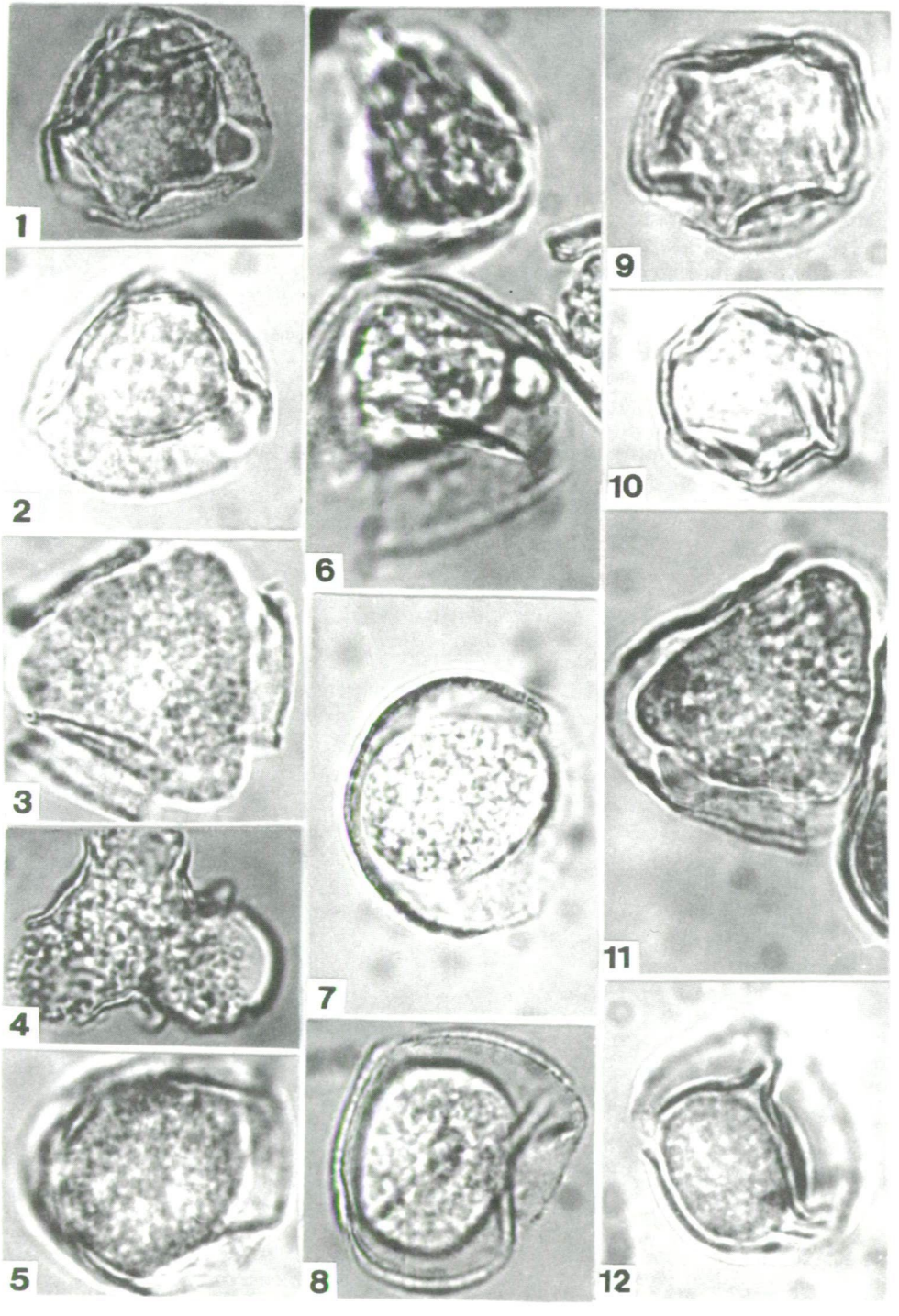
◂ Plate 3.1.

1–12. *Quercus robur* L., Recent.
1–4. Locality: F–1.
1,2. Experiment No: 1/7–97.
3,4. Experiment No: 1/7–98.
5–7. Locality: F–2.
5,6. Experiment No: 1/7–100.
7. Experiment No: 1/7–101.
8–10. Locality: U–1.
8,9. Experiment No: 1/7–103.
10. Experiment No: 1/7–104.
11,12. Locality: U–2, Experiment No: 1/7–106.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◂ Plate 3.2.

1,2. *Quercus robur* L., Recent., locality: U–2, Experiment No: 1/7–107.
3–6. *Quercus libani* OLIVER, Recent.
3,4. Experiment No: 1/7–94.
5,6. Experiment No: 1/7–95.
7–10. *Quercus pubescens* MILLD., Recent.
7–9. Experiment No: 1/7–109.
10. Experiment No: 1/7–110.
11,12. *Quercus cerris* L., Recent.
11. Experiment No: 1/7–112.
12. Experiment No: 1/7–113.

4. HIGH TEMPERATURE EFFECT ON THE POLLEN GRAINS OF THREE VARIETIES OF CULTIVATED MAIZE

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Abstract

The high temperature effect on the pollen grains of the open pollinated local varieties of cultivated maize was investigated with the LM method: Chapalote, Canario de Ocho and St. Croix Long Ear. The experiments were made on 200 °C temperature from 10' until 300 hrs. The qualitative alterations are essentially identical at the different varieties. The originally isodiametric, monoporate pollen grains altered secondarily to monosulcate, trichotomo- tetratomosulcate forms, several secondary ones assimilate to the pollen grains of the *Cyperaceae.* Among the alterations of the quantitative characters, differences were established between the investigated varieties. The presented results are important from the point of view of the evolution of the *angiosperm* pollen grains and of the taxonomical evaluation of the fossil pollen grains of *"Gramineae*-type".

Key words: Palynology, recent, high temperature effect, maize varieties.

Introduction

This contribution present part of the research program of our laboratory, namely the secondary alterations of the recent spores and pollen grains. Based on our previous published results, the alterations of the pollen grains in consequence of the high temperature may be important from the point of views as follows.

1. The quantitative alterations may be useful in the investigation of the organic material of the metamorphic sediments. In some cases the diameter and the size of the morphological characteristic features may be important in the determination of the fossil sporomorphs. Some characteristic features may altered in consequence of the sedimentation processes.

2. The qualitative alterations are useful from taxonomical and evolutionary point of view. Moreover, the experimentally produced secondary forms may be taken into consideration also at the evaluation of the fossil forms. At our first experiments (KEDVES and KINCSEK, 1989) early morphological characteristic features appeared at the pollen grains of *Corylus avellana* L. and *Betula verrucosa* L. after the high temperature effect. Later the opposite alteration has also been established. The secondary forms of the recent inaperturate pollen grains of *Taxus baccata* L. and *Juniperus virginiana* L. may be similar among others to the tricolpate earliest *an-*

giosperm pollen grains (KEDVES, TÓTH and FARKAS, 1991). It is possible, that among the described first Lower Cretaceous *angiosperm* pollen grains there are secondary forms of inaperturate *gymnosperm* pollen grains. TEM investigations are needed to solve this problem.

3. The evolutionary degrees of the *angiosperm* pollen grains in the Northern Hemisphere are based on the schemes of DOYLE (1977). The most important evolutionary stages are as follows. Monosulcate – tricolpate – tricolporate – *Normapolles*. This scheme is restricted to Europe, and the Atlantic Coast of North America. Based on new data, another, parallel lineage may also be presumed, as follows: The exine ultrastructure of the mesozoic isodiametric *gymnosperm Spheripollenites* COUPER 1958 is essentially of the *angiosperm* type (KEDVES and PÁRDUTZ, 1973). The LM studies demonstrated a non-characteristic pore-like aperture. This kind of *angiosperm* pollen evolutionary lineage may be originated from the *gymnosperms Spheripollenites* type and termined at the monoporate *angiosperm* pollen type, e. g.: *Gramineae, Restionaceae.*

Basically the aim was to investigate the secondary alterations of the monoporate pollen type. Moreover for the first time a cultivated species with three varieties was chosen for this kind of investigation. In this way the second point of view was to investigate the pollen morphology and the alterations of three local varieties within one cultivated species.

Materials and Methods

The pollen material was collected by Dr. A. PALÁGYI on 23. 08. 1991. Locality: Ságvári Experimental Research Station of the Cereal Research Institute. The pollen grains were frozen at –20 °C after collection. The experiments were made or started on 04. 09. 1991. Temperature 200 °C, length of time and numbers of experiments are as follows.

Lenght of time	Experiment No		
	Chapalote	Canario de Ocho	St. Croix Long Ear
0'	1217	1218	1219
10'	1220	1221	1222
1 h.	1223	1224	1225
5 hrs.	1226	1227	1228
10 hrs.	1229	1230	1231
25 hrs.	1232	1233	1234
50 hrs.	1235	1236	1237
100 hrs.	1238	1239	1240
200 hrs.	1241	1242	1243
300 hrs.	1244	1245	1246

The slides for light-microscopical investigations were mounted in glycerine-jelly hydrated at 39.6%. 200 specimens of each sample were investigated qualitatively and quantitatively. The pictures were taken with an objective Carl Zeiss Jena, GF Planachromat HI 100X/1.25/0.17–A.

General problems

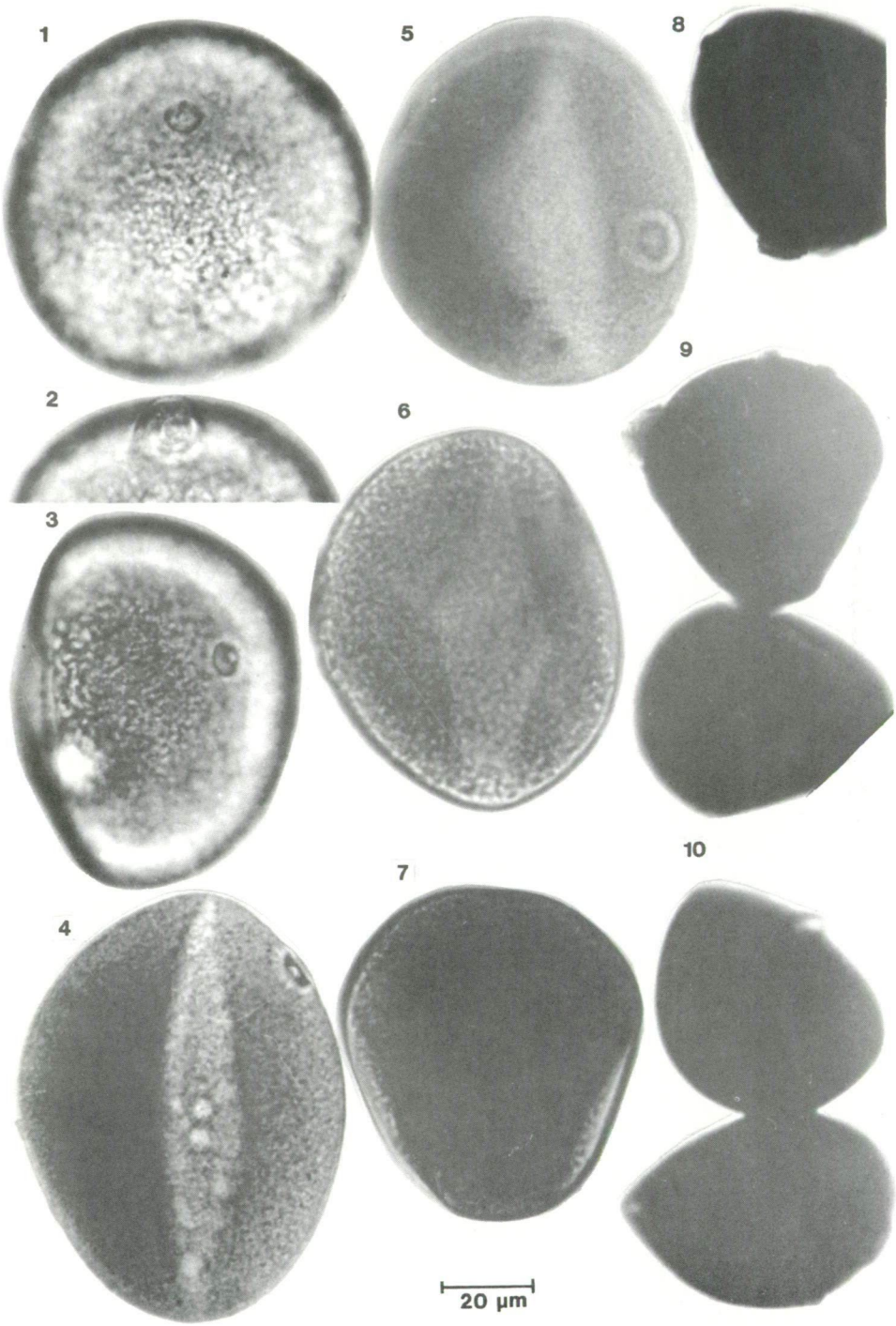
There is a number of palynological data about the pollen grains of the genus *Zea* L. Most of them are enumerated in the volumes of "Index bibliographique sur la morphologie des pollens d'Angiospermes", cf. THANIKAIMONI (1972, 1973, 1976, 1980, 1986). TISSOT (1990) and TISSOT and VAN DER HAM (1994). Based on the above mentioned compilations, as the earliest data the papers of MOHL (1834, 1835), HASSAN (1842) and FISHER (1890) can be pointed out.

The pollen grains of maize are typically of *"Gramineae* type"; spherical, monoporate, pore with operculum, and surrounded by annulus. Because of the agricultural importance, and the intensive experimental work to produce new local varieties or hybrids, it is important to publish full taxonomical data in every paper containing pollen data. Palynological data with the determination of *Zea mays* L. are only insufficient.

HUYNH (1975) established that the reproduction organells of the *Gramineae* are peculiar in several points of view: 1. The sporogene tissue is reduced to one single layer of mother cells. The arrangement of the microspores is isobilateral, etc. On microspore level at the cultivated maize SZAKÁCS (1992) described pollen dimorphism. "Dark" and "clear" microspores were distinguished: their size is identical, but there are differences in the structure of the cytoplasm. Within the problem of the pollen – stigma interaction of the grasses, the tissue organisation and the cytochemistry of the stigma of *Zea mays* L. was investigated by HESLOP-HARRISON, Y., REGER, and HESLOP-HARRISON, J. (1984). GRANT (1972) investigated with the SEM method the *Zea mays* L. ssp. *mays, Z. mays* L. ssp. *mexicana* (SCHRAD.) ILTIS (teosinte), *Zea perennis* (HITCHC.) REEVES and MANGELDORF (perennial teosinte), and two species of *Tripsacum* L. Based on the SEM data the *Zea* taxa pollen grains are similar pollen types, spinules scattered regularly over the exine surface. The surface of the *Tripsacum* species is characterized by distinctly reticuloid pattern with spinules on isolated lacunae. Hybrids between *Zea* and *Tripsacum* are intermediate in exine pattern or similar to *Tripsacum* depending on the genome combination. TSUKADA and ROWLEY (1964) summarized the three methods to distinguish maize pollen from that of other grasses: 1. The size (FIRBAS, 1937), 2. The ratio of the dimensions of the annulus and pore related to the size of the pollen grain (BARGHOORN, WOLFE and CLISBY, 1954), 3. The pattern of the spinules and infratectal

Plate 4.1. ►

1–10. *Zea mays* L. l. var. Chapalote, Recent.
1,2. Pollen grains without heating.
3. Experiment No: 1220, length of time 10 min.
4,5. Experiment No: 1223, length of time 1 hr.
6. Experiment No: 1226, length of time 5 hrs.
7. Experiment No: 1229, length of time 10 hrs.
8. Experiment No: 1238, length of time 100 hrs.
9. Experiment No: 1241, length of time 200 hrs.
10. Experiment No: 1244, length of time 300 hrs.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elements (columellae) (ERDTMAN, 1956, etc.). Finally they established fossil maize pollen from Guatemala. BARTLETT, BARGHOORN and BERGER (1969) based on their palynological studies demonstrated wild maize, agricultural maize, and Manihot from about 7.300 years old sediments in the Gatun Basin, Panama.

The above mentioned few selected bibliographical data verified the complexity of the problem of the maize pollen grains and its importance.

Results

QUALITATIVE DATA

The LM microscopy revealed differences between fresh pollen grains of the investigated three local varieties. Based on our present data, two pollen morphotypes can be established:

1. Chapalote and St. Croix Long Ear
2. Canario de Ocho

SEM and TEM data are necessary to establish the fine differences between the above mentioned two types, because using the LM method we observed differences in the organelles of the protoplasm, and in the surface ornamentation also.

The high temperature effect resulted in the following secondary forms:

Monocolpate (monosulcate), (Plate 4.1., figs. 3,4, plate 4.3., figs. 5,6).

Trichotomosulcate (Plate 4.1., fig. 5, plate 4.2., fig. 7, plate 4.3., fig. 7).

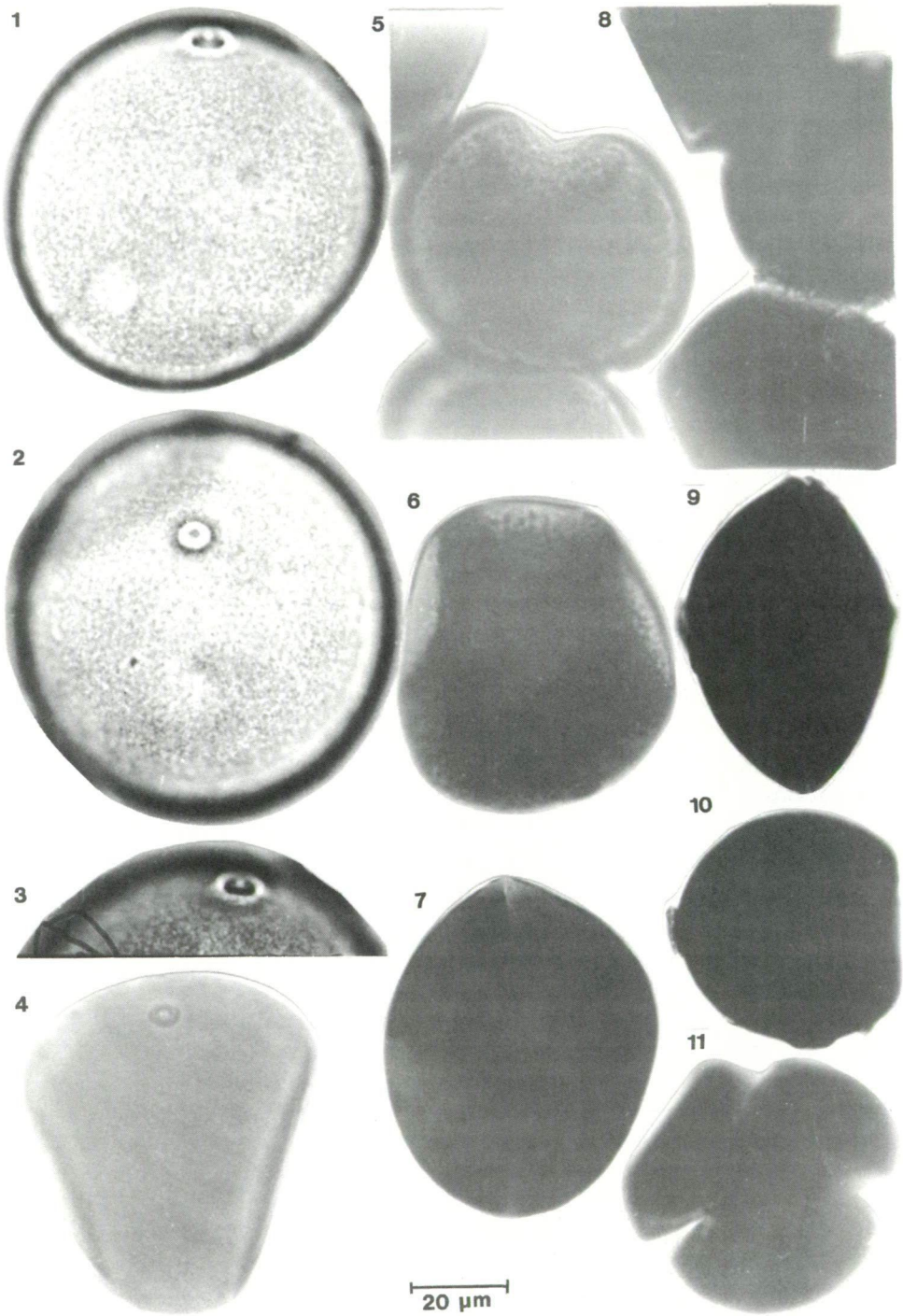
Tetratomosulcate (Plate 4.1., fig. 6, plate 4.3., figs. 4,6).

"Cyperaceae-like forms" (Plate 4.1., fig. 7, plate 4.2., fig. 6).

Opaque, very damaged forms (Plate 4.1., figs. 8–10, plate 4.2., figs. 8–11, plate 4.3., figs. 8–10).

Plate 4.2.

1–11. *Zea mays* L. l. var. Canario de Ocho, Recent.
1–3. Pollen grains without heating.
4. Experiment No: 1224, length of time 1 hr.
5. Experiment No: 1227, length of time 5 hrs.
6. Experiment No: 1230, length of time 10 hrs.
7. Experiment No: 1233, length of time 25 hrs.
8. Experiment No: 1236, length of time 50 hrs.
9. Experiment No: 1239, length of time 100 hrs.
10. Experiment No: 1242, length of time 200 hrs.
11. Experiment No: 1245, length of time 300 hrs.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The per cents of the different secondary forms by the local varieties

Zea mays L. 1. var. Chapalote

Per cents of the pollen forms	Length of time									
	0	10'	1^h	5^h	10^h	25^h	50^h	100^h	200^h	300^h
Non-altered	100.0	84.5	37.5	36.5	22.5	12.5	18.5	19.5	32.5	32.0
Monocolpate		9.5	43.5	42.0	45.0	48.0	46.0	46.0	37.5	42.5
Cyperaceae-like		6.0	17.5	15.0	19.5	24.0	21.5	22.0	21.0	17.5
Trichotomosulcate			1.5	6.5	12.5	14.0	14.0	12.5	9.0	8.0
Tetratomosulcate					0.5	1.5				

Zea mays L. 1. var. Canario de Ocho

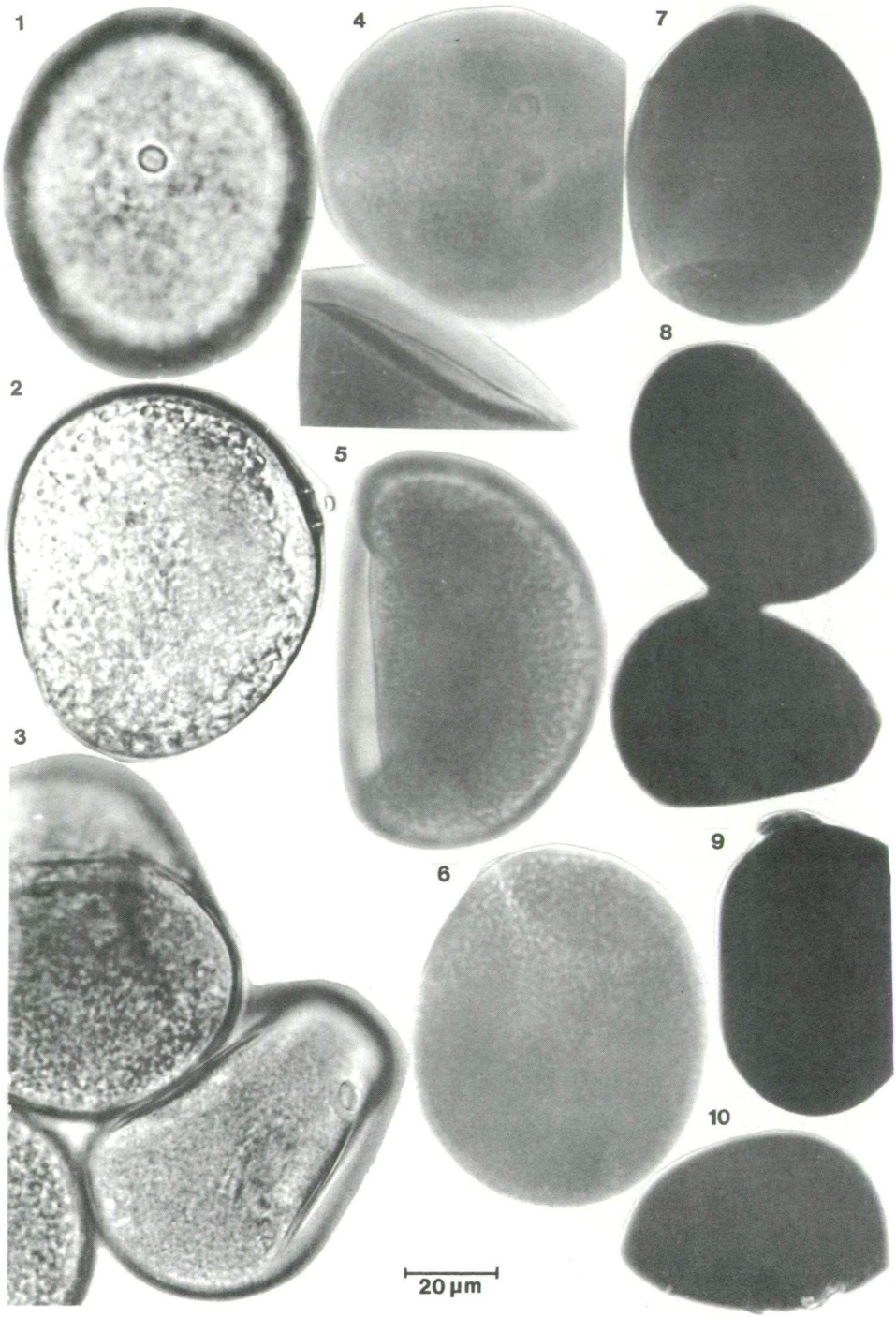
Per cents of the pollen forms	Length of time									
	0	10'	1^h	5^h	10^h	25^h	50^h	100^h	200^h	300^h
Non-altered	100.0	91.0	40.0	38.0	17.5	17.5	21.0	20.5	26.0	23.5
Monocolpate		6.5	36.5	41.0	47.0	31.5	35.0	39.5	37.0	42.5
Cyperaceae-like		2.5	22.0	13.5	23.0	25.5	28.5	25.5	31.0	21.0
Trichotomosulcate			1.5	7.5	11.5	23.0	15.5	14.5	6.0	12.5
Tetratomosulcate					1.0	2.5				0.5

Zea mays L. 1. var. St. Croix Long Ear

Per cents of the pollen forms	Length of time									
	0	10'	1^h	5^h	10^h	25^h	50^h	100^h	200^h	300^h
Non-altered	100.0	86.5	27.5	30.5	15.5	7.0	13.0	17.5	24.0	27.5
Monocolpate		10.0	44.5	50.0	50.5	51.0	48.5	49.0	50.0	49.5
Cyperaceae-like		3.5	15.5	15.0	18.0	26.0	23.0	24.5	20.0	13.5
Trichotomosulcate			7.5	4.0	9.0	10.5	15.5	9.0	6.0	9.0
Tetratomosulcate			5.0	0.5	7.0	5.5				0.5

Plate 4.3. ►

1–10. *Zea mays* L. l. var. St. Croix Long Ear, Recent.
1,2. Pollen grains without heating.
3. Experiment No: 1222, length of time 10 min.
4. Experiment No: 1225, length of time 1 hr.
5. Experiment No: 1228, length of time 5 hrs.
6. Experiment No: 1231, length of time 10 hrs.
7. Experiment No: 1234, length of time 25 hrs.
8,9. Experiment No: 1237, length of time 50 hrs.
10. Experiment No: 1240, length of time 100 hrs.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Regarding the distribution of the percentages of the different pollen forms, the following can be pointed out:

1. At the investigated three local varieties of *Zea mays* L. the fresh pollen grains are more or less isodiametric, monoporate type.
2. Monosulcate (colpate) and *Cyperaceae*-like secondary forms appeared after 10' of heating at 200 °C in a remarkable per cent.
3. The pollen grains heated for one hour altered secondarily in a remarkable proportion. The amount of the monocolpate + *Cyperaceae*-like forms is more than 50% (43.5 + 17.5, 36.5 + 22.0, 44.5 + 15.5). Secondarily trichotomosulcate forms are relatively few, 1.5 at the varieties Chapalote and Canario de Ocho, higher, 7.5% at the variety St. Croix Long Ear. At this latter mentioned local variety tetratomosulcate secondary forms also appeared. This secondary form was observed in a remarkable quantity at this variety only after heating for 1–25 hours.
4. From 5 hours until 300 hours of heating the monocolpate forms are dominant. The so-called "normal monoporate forms" are similar or nearly in equal proportion to the *Cyperaceae*-like forms.
5. To the presented percentages it is necessary to emphasize that after 25 hours of heating the colour of the pollen grains is extremely dark, in this way sometimes it was not easy to establish the character of the secondary forms.
6. After 200 hours of heating several further secondary alterations appeared. The apertural area became very proeminent, this is more characteristic after 300 hours, accompanied by broken forms (Plate 4.2., fig. 11). Another alteration is when pollen grains are in pairs (Plate 4.1., figs. 10,11, plate 4.2., fig. 8, plate 4.3., fig. 8).

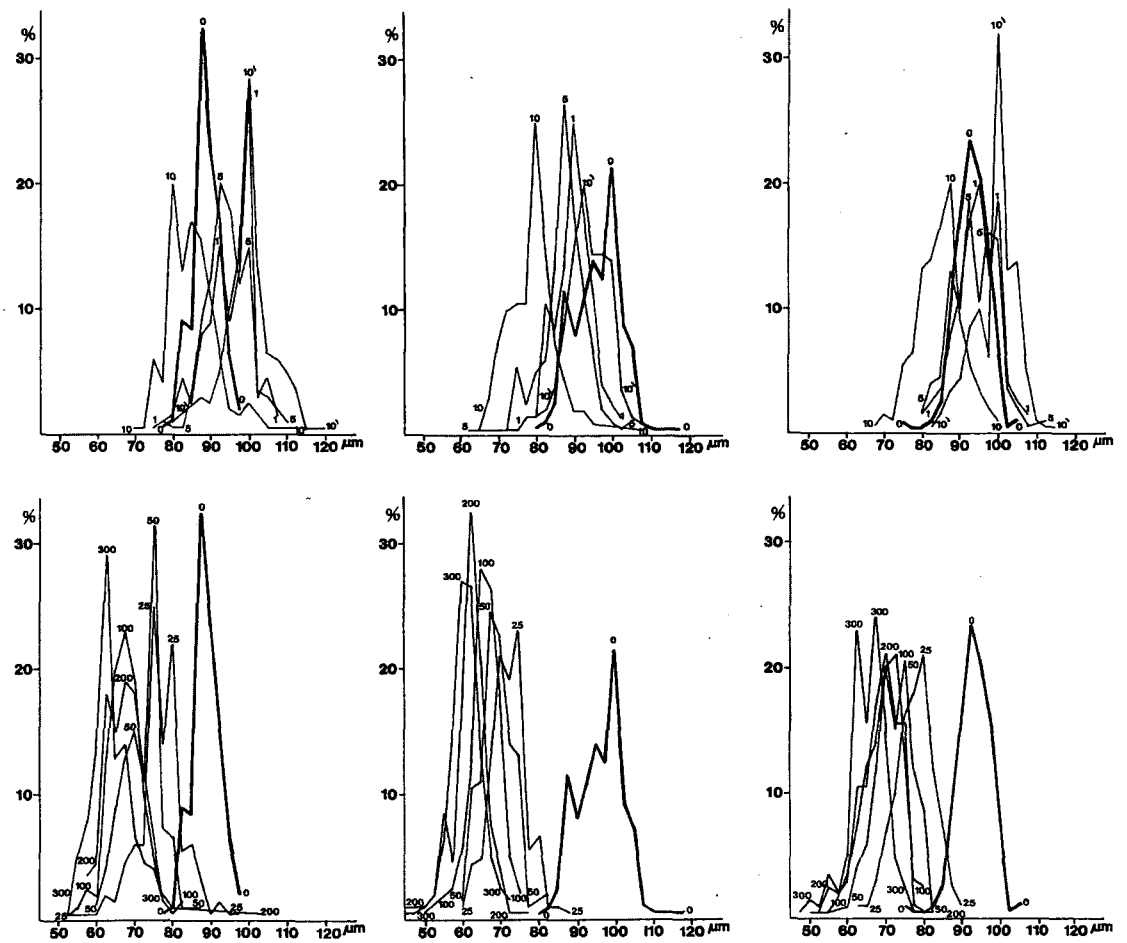
QUANTITATIVE DATA
(Text-figs. 4.1. and 4.2.)

1. Regarding the largest size of the investigated varieties, there are differences. The 2nd variety (Canario de Ocho) is the largest, the smaller is the 3rd (St. Croix Long Ear). At this latter mentioned variety the shape is also different in a remarkable quantity there are ellipsoidal forms also.
2. After 10' of heating the pollen grains of the 1st and the 3rd varieties started to swell, in contrast to this the originally largest pollen grains of the 2nd variety start to contract. Similar alterations happened in the P/A ratio in this case this is the ratio of the longest and the shortest dimension of the pollen grains. The data are as follows.

2.1. 1. var. Chapalote 1.0–1.9
2.2. 1. var. Canario de Ocho 1.0–1.4
2.3. 1. var. St. Croix Long Ear 1.0–1.9

3. Heating for 1 hour resulted at all varieties contraction. But the size at the 1st and the 3rd varieties does not reach the size of the pollen grains because in the first phase of heating these pollen grains have been swelled.
4. Results after heating for 5 hours. The size of the first variety has not reached the original size of the fresh pollen grain. It is interesting that the size of the 3rd variety is identical after this heating to the fresh pollen grain.

5. Heating for 10 hours resulted in a characteristic contraction at every varieties investigated. This continues after heating for 25 hours.
6. From 50 hours of heating the colour of the pollen grains is very dark, in some cases the determination of the morphological characteristic features is not easy.

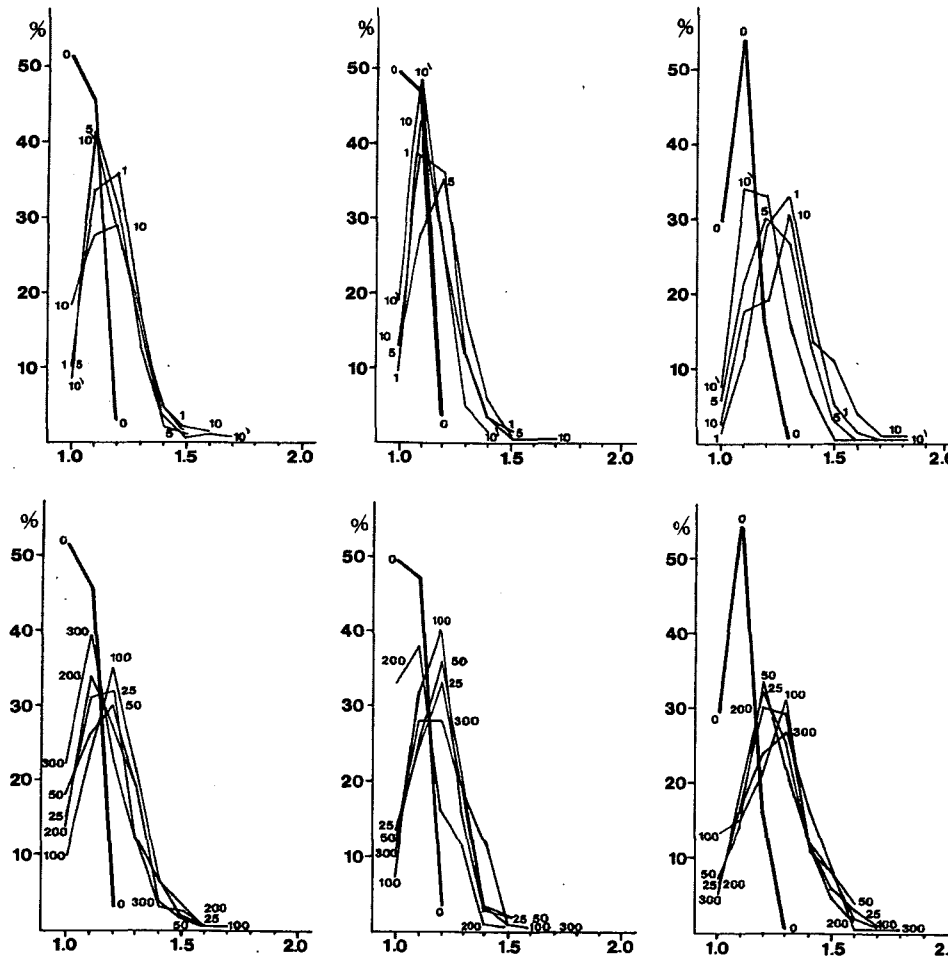


Text-fig. 4.1.

Variation-statistical diagrams of the diameter and/or the longest size of the pollen grains. From left to right: *Zea mays* L. l. var. Chapalote, *Zea mays* L. l. var. Canario de Ocho, *Zea mays* L. var. St. Croix Long Ear.

7. After heating for 100–200 and 300 hours, the decrease of the size of the pollen grains continues, but after 200 hours the diminution of the diameter is not so definite.

Finally, the alteration of the P/A ration is one thing to emphasize that the 1st and the 2nd varieties are similar, the 3rd is quite different from the previous ones.



Text-fig. 4.2.

Variation-statistical diagrams of the secondary P/E ratio of the pollen grains. From left to right: *Zea mays* L. l. var. Chapalote, *Zea mays* L. l. var. Canario de Ocho, *Zea mays* L. var. St. Croix Long Ear.

Discussion and Conclusions

On the basis of our recent results we can conclude the following:

1. There are remarkable differences in some of the morphological characteristic features of the pollen grains of the local varieties investigated. These differences appeared at the experimentally altered forms too. As it was emphasized previously, the TEM and SEM investigations are also necessary. Moreover, the dissolution method by organic solvents may also result in several new additions to our knowledge. In general it seems that during our experimental studies it is necessary to pay more attention to the pollen grains of the cultivated varieties.
2. The sphere as it is well known is an early form. From evolutionary point of view, the *Gramineae* type pollen grain may be originated morphologically from inaperturate *gymnospermous* ancestors, cf. *Spheripollenites* COUPER (1958). It was presumed previousy (KEDVES, TÓTH and FARKAS, 1991) that above the scheme of DOYLE (1977) concerning the evolutionary lineages of the *angiosperm* pollen grains, further, parallel lineage or lineages may also be presumed, within the *Normapolles* province.
3. The secondary forms, which appeared in consequence of the high temperature effect are very important from the point of view of the phylogeny of the *angiosperm* pollen grains. Here is the first place the appearance of the monosulcate form must be pointed out. The monosulcate pollen form is very common in several *gymnosperm* taxa. Trichotomosulcate pollen grains occur together with monosulcate ones often at the palms.

Finally, the monoporate – monosulcate alteration is important from the point of view of the fossil *Gramineae* pollen grains. In 1965 KEDVES described the *Monocolporopollenites* form-genus with two form-species from the Eocene layers in Hungary. KRUTZSCH (1970) established that the *Monocolporopollenites* fgen. may be synonymous to *Graminidites* COOKSON 1947 and published following new combinations:

G. grandiosus (KEDVES 1965) n. comb.
Monocolporopollenites grandiosus n. fsp. – KEDVES 1965, S. 336/7. Abb. 8, Taf. 3, Fig. 5 (Dorog-Gebiet/Ungarn; mittleres Eozän)
G. dorogensis (KEDVES 1965) n. comb.
Monocolporopollenites dorogensis n. fsp. – KEDVES 1965, S. 337, Abb. 10. Taf. 3, Figs. 6–7 (Dorog-Gebiet/Ungarn; mittleres Eozän)

Based on the results of our experiments, the taxonomical concept of KRUTZSCH (1970) has been verified. The *monocolporate* form may be a secondary alteration of the originally globular monoporate type.

Acknowledgements

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5. X-RAY EFFECT TO THE LM MORPHOLOGY OF SOME GYMNOSPERM AND ANGIOSPERM POLLEN GRAINS

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Abstract

Pollen grains of the following species were the subject of our investigations: 1. Inaperturate *gymnosperm (Juniperus virginiana)* and *angiosperm (Populus canadensis)*, 2. Monosulcate *angiosperm (Magnolia kobus)*, 3. Brevaxonate, vestibulate *angiosperm* pollen grains *(Betula verrucosa, Alnus subcordata)*. Length of irradiation: 35' with 35 KV, 20 mA, CuK_{α}. The alterations of the light-microscopical palynological characteristic features were the subject of our investigations, in particular the development of the pollen tube. Among the results the X-ray indicated germination at inaperturate *gymnosperm* pollen grains *(Juniperus virginiana)* may be pointed out. On the basis of the first results in this research program it is believed, that this alteration occurs at the *angiosperm* pollen grains.

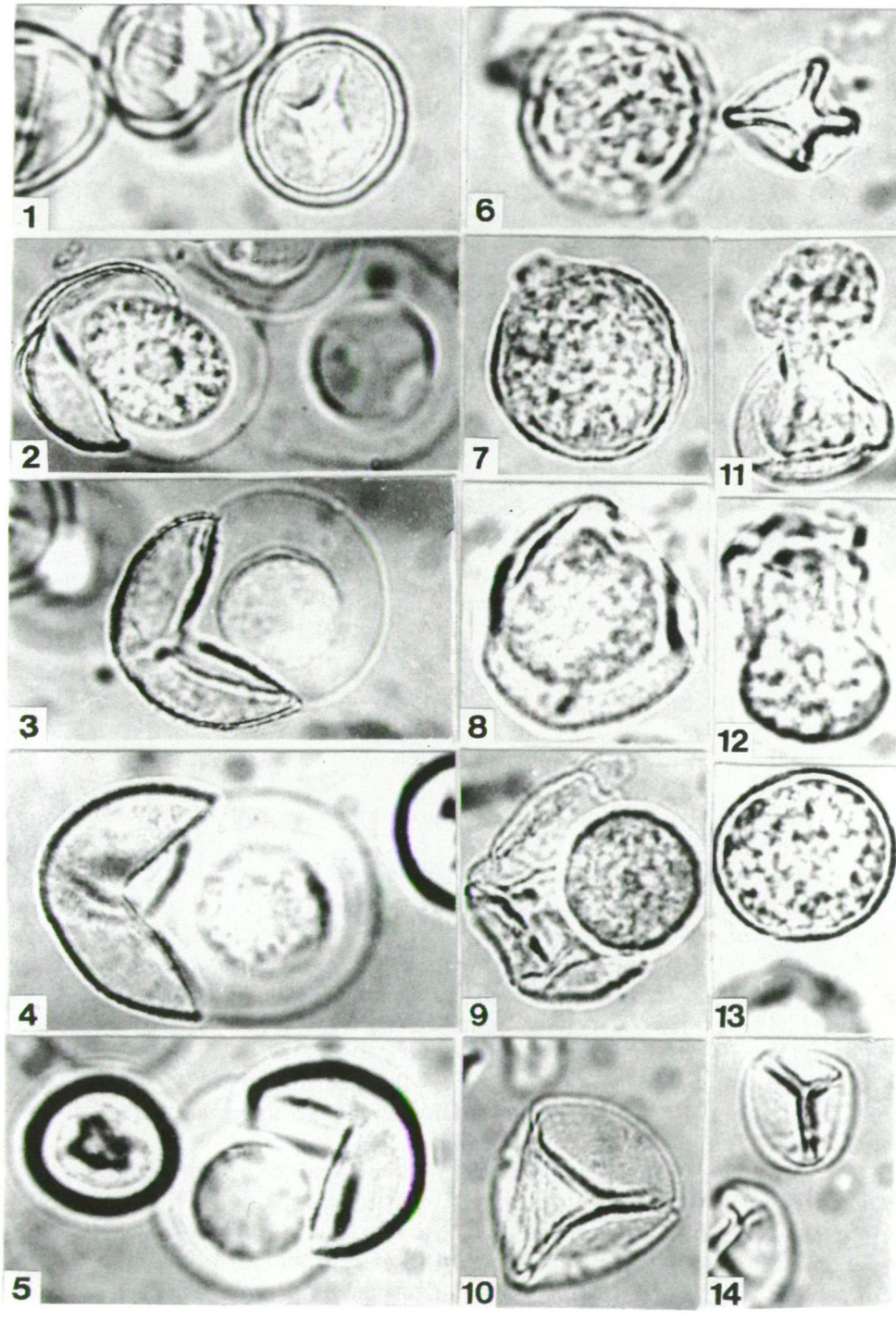
Key words: Palynology, *gymnosperm, angiosperm,* X-ray effect, light microscopy.

Introduction

Our research program in this field was focussed firstly to the secondary alterations of the biopolymer system of the sporoderm (cf. KEDVES and PÁRDUTZ, 1992). During these investigations with the TEM method also secondary, X-ray induced pollen tube development was observed. Later, KEDVES and GÁSPÁR (1995) investigated with the LM method the secondary alterations of the X-ray irradiation at the species as follows: *Ustilago maydis* (DE CANDOLLE) CORDA, *Equisetum arvense* L., *Pinus griffithii* MCCLELL, *Taxus baccata* L. and *Salix alba* L. The X-ray effect induced pollen tube development was observed only at the pollen grains of the *angiosperm Salix alba.* Based on the above mentioned few data the following problems arose:

1. Is this alteration indeed characteristic of the angiosperm pollen grains?
2. Taxonomic and/or phylogenetic conclusions may be draws an inference from these data?
3. What is the importance of the basic morphology of the sporomorphs?
4. The importance of peculiar protective materials in the wall and/or in the protoplasm? Melanins are in the first place in this respect (cf. PIROZYNSKI, 1977).

Taking into consideration the above mentioned problems in our laboratory a program of research was planned for the advancement in this field. This contribution is a part of this program.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Materials and Methods

The data of the investigated species are the following:

Juniperus virginiana L.

Locality: Botanical Garden of the J. A. University. Collected: J. PULICS, on 16. 03. 1995. Irradiation: on the 30. 03. 1995, LM investigation: on the 01. 04. 1995.

Populus canadensis MÖNCH. (*deltoides* MARSH x *nigra* L.).

Locality: Ujszeged the left river-side of Tisza. Collected: M. KEDVES, on 05. 04. 1995. Irradiation: on the 06. 04. 1995, LM investigation: on the 19. 04. 1995.

Magnolia kobus L.

Locality: University Garden (Egyetem u. 2) Collected: Á. KÁROSSY, on 03. 04. 1995. Irradiation: on the 06. 04. 1995, LM investigation: on the 19. 04. 1995.

Betula verrucosa EHRB.

Locality: Botanical Garden of the J. A. University. Collected: J. PULICS, on the 21. 03. 1995. Irradiation: on the 29. 03. 1995,

LM investigation: on the 29. 03. 1995.

Alnus subcordata C. A. MEY

Locality: Botanical Garden of the J. A. University. Collected: I. SZÖLLŐSI, on the 14. 03. 1995. Irradiation: on the 19. 04. 1995.

LM investigations on the 19. 04. 1995. The irradiations were made with the BRON–OM1 apparatus in the Radiological Laboratory of the Department of Mineralogy, Petrology and Geochemistry of the J. A. University, Szeged. Radiation data: 35KV, 20 mA, CuK_{α} beam. Length of irradiation: 35'.

Results

Juniperus virginiana L. (Plate 5.1., figs. 1–5)

Four kinds of pollen grains were observed after irradiation:

1. No alterations in the LM morphology; 43% (Plate 5.1., fig. 1).

2. No morphological alteration, but the degradation of the outer part of the ectexine is remarkable; 7.0%.

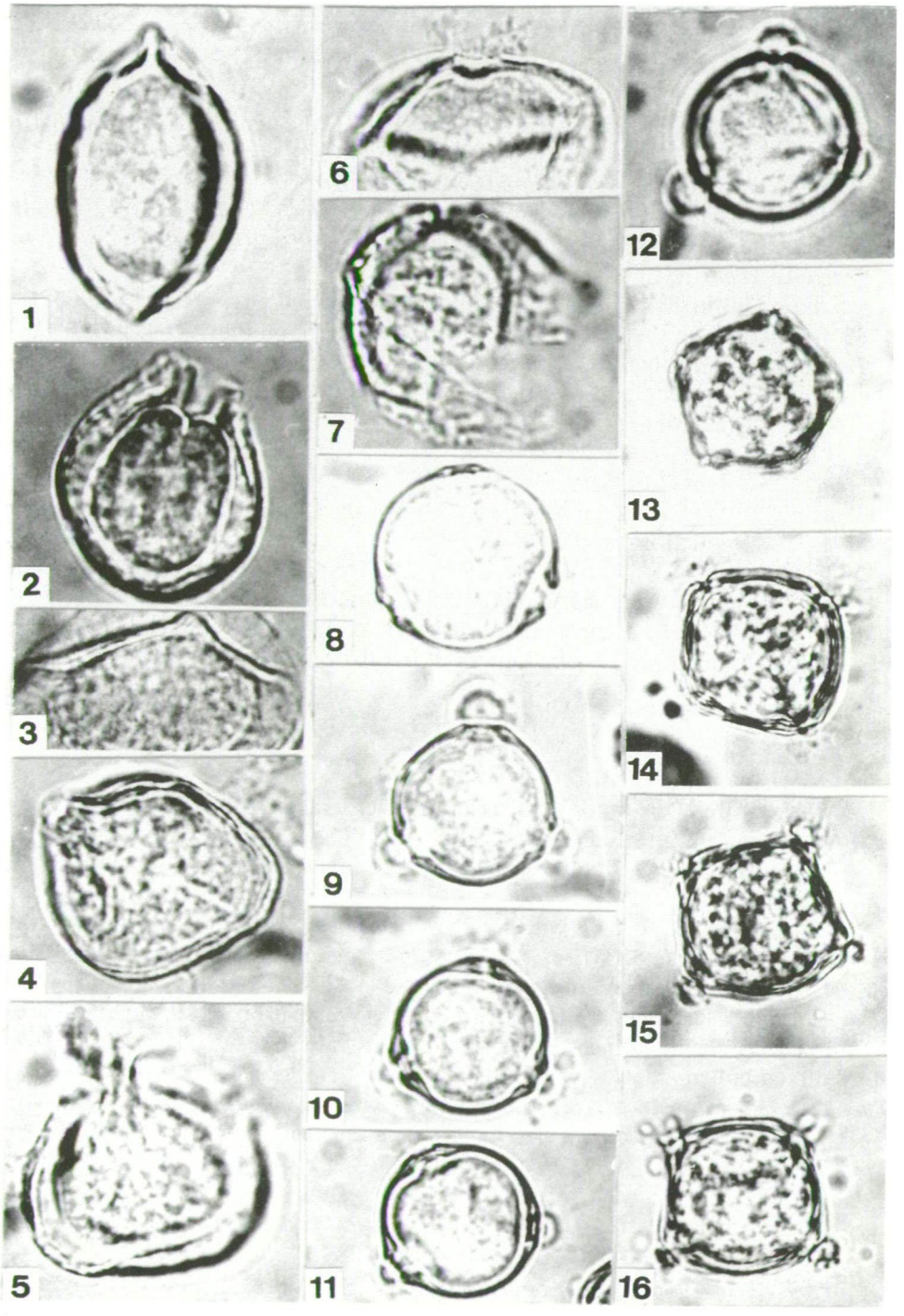
3. Opened "hiatus forms", with remarkable thickening of the inner wall layer, probably intine (Plate 5.1., figs. 2–5). In some specimens the nucleus is also well shown. This kind of pollen grains was observed in 47.5%.

4. Ectexine lost pollen grains, with an inner globular protoplasm surrounded by a thickened, probably intine, see the right pollen grain in fig. 2, Plate 5.1., 2.5% of such altered pollen grains were observed.

Populus canadensis MÖNCH. (*deltoides* MARSH x *nigra* L.) (Plate 5.1., figs. 6–14)

◂ Plate 5.1.

1–5. *Juniperus virginiana* L., Recent, Experiment No: 1/7–88.
6–14. *Populus canadensis* MÖNCH. (*deltoides* MARSH. x *nigra* L.), Recent, Experiment No: 1/7–91.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A number (70%) of pollen grains without protoplasm were observed. These are without doubt sterile pollens. It is interesting, that there are peculiar forms between them. Foldings similar to the "Y" tetrad mark (Plate 5.1., fig. 14), "tetralete form" (Plate 5.1., fig. 6, the pollen grain of the right corner of the picture) and "plicatoide types" similar to the *myrtaceous* pollen grains (Plate 5.1., fig. 10). The non-altered pollen grains with protoplasm (Plate 5.1., fig. 6, left corner of the picture, and fig. 13) represent 25.5%. The development of the pollen tube is interesting (Plate 5.1., figs. 7,11,12). Very small tube is illustrated in picture 7, of the Plate 5.1. Characteristic specimens are illustrated on the microphotographs 11, and 12 in the Plate 5.1. This kinds of pollen grains represent 4%. As the most interesting alteration, the forms which are similar to the altered pollen grains of *Juniperus virginiana* may be pointed out (Plate 5.1., figs. 8,9). The "hiatus form" (Plate 5.1., fig. 9) is rare (0.5%), the extremely thickened intine, with globular protoplasm is scarce (Plate 5.1., fig. 8). Worth of mentioning is that the ectexine was not seemingly damaged.

Magnolia kobus L. (Plate 5.2., figs. 1–7)

The typically monosulcate pollen grains (Plate 5.2., figs. 1,2) represents one of the earliest *angiosperm* pollen type. The morphological characteristic features of the apertural area are well shown in the polar view of the pollen grains (Plate 5.2., fig. 2). Pollen tube development in consequence of the X-ray irradiation was observed at 9.5% of the pollen grains (Plate 5.2., figs. 4–6). 4.5% of the altered pollen grains represent the opened (hiatus) forms, which are similar to the previous two species. Most per-cent (76.0%) of the pollen grains are non-altered (e. g.: Plate 5.2., fig. 1). Pollen grains without ectexine and with thickened intine were observed in 10.0% (Plate 5.2., fig. 3).

Betula verrucosa EHRB. (Plate 5.2., figs. 8–12)

The expansion of the onci were observed at nearly all of the pollen grains after irradiation. (Plate 5.2., fig. 8). The pollen tube development at all the apertures was observed at 49.0% of the pollen grains (Plate 5.2., figs. 9–12). At 51.0% of the irradiated pollen grains tube development was not observed.

Alnus subcordata C. A. MEY. (Plate 5.2., figs. 13–16)

After irradiation the onci slightly increased. The greatest part of the pollen grains are non-altered; 86.5% cf. Plate 5.2., fig. 13. The pollen tube development was observed at 13.5% of the pollen grains (Plate 5.2., figs. 14–16). But the pollen tube development at every aperture of the pollen grains was observed at 3.5% only.

◂ Plate 5.2.

1–7. *Magnolia kobus* L., Recent, Experiment No: 1/7–90.
8–12. *Betula verrucosa* EHRB., Recent, Experiment No: 1/7–87.
13–16. *Alnus subcordata* C. A. MEY., Recent, Experiment No: 1/7–89.

Discussion and Conclusions

The new data in comparison with the previous ones may be interpreted as follows:

1. The interesting secondary forms of the pollen grains of *Juniperus virginiana* are unexpected in contrast to the observations at the pollen grains of *Taxus baccata.* To this the results of DUHOUX (1975) are worth of mentioning, the observed aperture-like exine differentiations. The rich LM results of M. VAN CAMPO (1947, 1951, 1953) are also very important. It may be concluded, that the further investigations on inaperturate *gymnosperm* pollen grains will be resulted in future further interesting new data. As regards our up-to-date results on the pollen grains of *Populus canadensis* we can emphasize some similarities between the secondary forms of the pollen grains of *Juniperus virginiana.* In this way the similar or identical morphology may results in similar alterations or secondary forms. M. VAN CAMPO (1947) observed tetrad mark-like foldings at the pollen grains of *Cryptomeria japonica.*

2. X-ray effect induced pollen tube development was observed at the *angiosperm* monosulcate pollen grains of *Magnolia kobus.* Taking into consideration our previous results on the pollen grains of *Ginkgo biloba,* the similar morphology have not resulted in similar alterations in contrast to the above discussed inaperturate forms.

3. The differences in the percentages of the pollen tube development of the genuses *Betula* and *Alnus* are also interesting. This may be induced further multidisciplinary investigations.

In resumé on the basis of our present day knowledges in this subject we can established, that the X-ray induced pollen tube development at one group of the pollen grains is a remarkable contribution in the determination of the radioactivity of the recent sediments.

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6. COMPUTER MODELLING OF THE QUASI-CRYSTALLOID BIOPOLYMER STRUCTURE II.

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Abstract

During our previous investigations (1995) on the structure and symmetry of the biopolymer system of the partially degraded plant cell wall we have recognized that a part of the problems can be resolved exclusively by computer modelling. Another research program was projected in our laboratory, based on two opposite statepoints as follows. 1. The computer modelling of the biopolymer structures based on TEM observations. 2. Presumed or hypothetical structures which, till this time have not been observed on biological objects. This contribution presents the first computer modelling of a "nonsense" spherical calotte composed of regular pentagon units.

Key words: Plant cell wall, biopolymer system, computer modelling.

Introduction

A long time ago it was established that the sphere is the most perfect figure, because every point of the spherical surface is in an equal distance from the central point of the sphere. Another characteristic feature is that the sphere have the largest specific surface. In the inorganic macro- and micro-cosmos, and in organic, living structures, the sphere ("coccoid form") is very common.

As some selected example the following can be pointed out: PFLUG (1965a,b) in his first publications on the Precambrian biotas distinguished globular and filamentous structures. The extinctions on the K/T boundary are explained by KREMP (1990–91) by the expansion of the Earth. To this the "Pangean-polygon" of CAREY (1976) was an important hypothesis. The more or less isodiametric "Pangean-polygon" surface is composed of regular pentagons. Each pentagon increased by the same proportion. To this our, three dimensional modelling of the quasi-crystalloid skeleton was based on a pentagon dodecahedrane (KEDVES, 1990, 1991). The fullerenes which may serve as models for some biopolymer structures (cf. HARGITTAI, 1990) are quasi-equivalent systems (KEDVES and ROJIK, 1994). The quasi-crystals (SHECHTMAN, BLECH, GRATIAS and CAHN, 1984) may be interpreted with the PENROSE tiling (cf. PENROSE, 1979, NELSON, 1986). The quasi-crystalloid biopolymer structure was established in the plant cell wall (e. g.: KEDVES, 1990). The system is composed of a metastable skeleton, and a stabilizing system (KEDVES and TÓTH, 1994).

The aim of this paper is the modelling of the sphere with quasi-periodic elements, namely regular pentagons, and investigate the points of symmetry and the different kinds of holes (frustrations, sensu NELSON, 1986) of this system.

Methods

The computer modelling was made as follows:

1. Spherical calotte with the points of symmetry and the network of the regular pentagons (Text-fig. 6.1.).

2. The points of symmetry of the pentagons, and the central pentagon surrounding in two circles of pentagons (Text-fig. 6.2.).

3. The different kinds of holes and the central pentagon (Text-fig. 6.3.).

The interpretation of the computer data of the two dimensional schemes started from the central pentagonal plane of the calotte. In this way the analysis of the modelled characters may be serve in the reconstruction of the two dimensional schemes in the space.

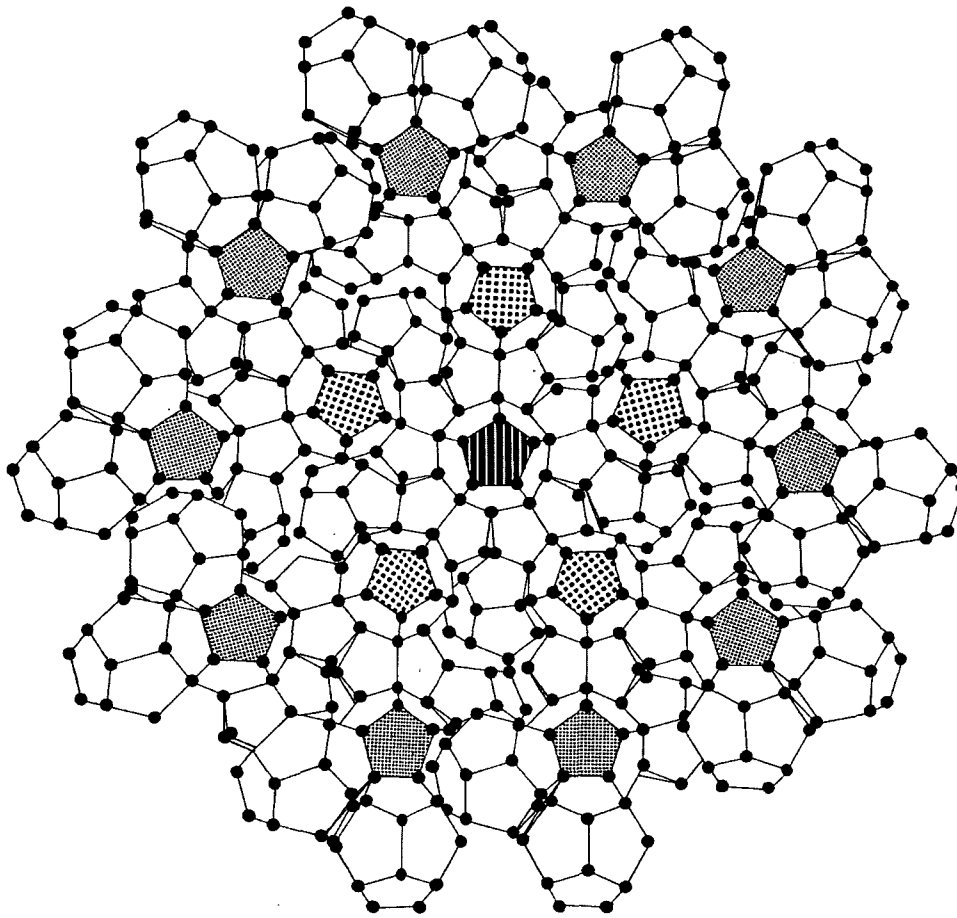
Results

1. PLANES, NETWORK AND POINTS OF SYMMETRY OF THE SPHERICAL CALOTTE (Text-fig. 6.1.)

1.1. The regular pentagonal planes

The central regular pentagon (streaked) is surrounded in two circles by further regular pentagonal planes. The first circle is composed of five pentagons (dotted with larger points) which are connected by its network to the edges of the central plane. The central pentagon which is effectively one side of the pentagon dodecahedrane, is surrounded by further pentagon dodecahedrane units. But in this case the five surrounding pentagonal planes are elements of a so-called "frustrated PENROSE-unit" in consequence of the forced quasi-equivalent arrangement of the quasi-periodic building elements. In the second circle of the regular pentagonal planes there are ten pentagons (dotted by tiny points). Each two of them is connected by one of their edges to the pentagons of the first circle. The pentagonal planes of the second circle elements of more frustrated Penrose units.

1.2. The network is composed of the sides of the regular pentagonal planes of the dodecahedranes which compose incontinuously the spherical calotte. This network well illustrates the peculiarity of this kind of spherical calotte. Namely the central pentagon is surrounded by ten edges, essentially this unit represents the central pentagon dodecahedrane. These points of symmetry are the bases of the ten pentagonal planes surrounding the central dodecahedrane. Each two surrounding pentagonal plane represents one unit, between them there are frustrations (sensu NELSON, 1986). The surrounding five pentagon represents also a dodecahedrane with minor positional differences to the central one. In contrast to these the pentagons of the second circle are peculiar, each second dodecahedrane is covered by another two



Text-fig. 6.1.

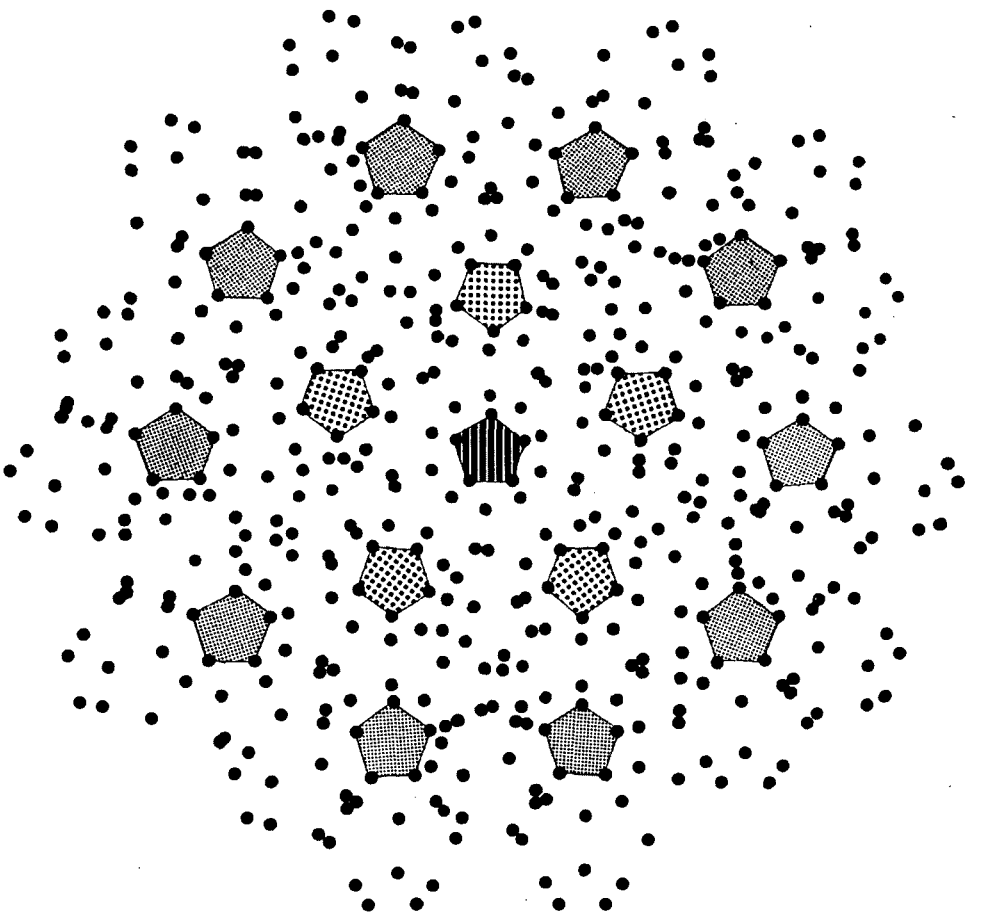
Scheme of the computer modelled spherical calotte composed of regular pentagonal planes. Illustrated are: 1. The central pentagonal plane (streaked) surrounded in two circles by further pentagonal planes (dotted). 2. The points of symmetry of the edges of the dodecahedrane. 3. The network of the superficial elements.

nearby pentagon dodecahedranes. In this way the points of symmetry surrounding the pentagonal planes of the second circle are the edges of two or three dodecahedranes. This phenomenon may be illustrated well by the symmetry of this points surrounding the regular pentagonal plane.

1.3. The points of symmetry are the edges of the pentagonal units. The points of symmetry together with the network lines well illustrate the position of the pentagonal planes which form the dodecahedrane elements. The disposition and/or the accumulation of the points of symmetry illustrate the position including the holes of the pentagon dodecahedrane elements.

2. PLANES AND POINTS OF SYMMETRY OF THE SPHERICAL CALOTTE (Text-fig. 6.2.)

The points of symmetry are the edges of the pentagon dodecahedrane units. The pentagonal planes are also illustrated as previously for orientation and for comparison to the previous figure (Text-fig. 6.1.). The network was omitted. The arrangement of the ten points of symmetry surrounding the pentagonal planes well represents the orientation of the dodecahedranes. Well shown is the regular position of the central pentagon. The ten points are on a regular circle. On the further circle of points there are also ten points, but paired. The twin points of the second circle are in the face of one point of the first circle. These three points represent



Text-fig. 6.2.

The points of symmetry of the edges of the dodecahedranes of the computer model of the spherical calotte and the pentagonal planes, illustrated in Text-fig. 6.1.

one kind of frustration between the dodecahedrane units. The further five single points of symmetry, near the second circle are opposite to the other five points of the first circle. These latter mentioned points are in the line of the edges of the two pentagonal planes respectively the central pentagon and one of the pentagons of the first circle. As regards the pentagonal planes of the first circle of pentagons, it is not so easy to establish the ten surrounding points of symmetry similarly to the central pentagon. This is in consequence of the space arrangement of the dodecahedrane units. These are in different kinds of arrangement. The peripherial units of the calotte are well represented by the points of symmetry of the edges of the pentagon dodecahedranes.

3. THE DIFFERENT KINDS OF HOLES AMONG THE BUILDING ELEMENTS OF THE SPHERICAL CALOTTE (Text-fig. 6.3.)

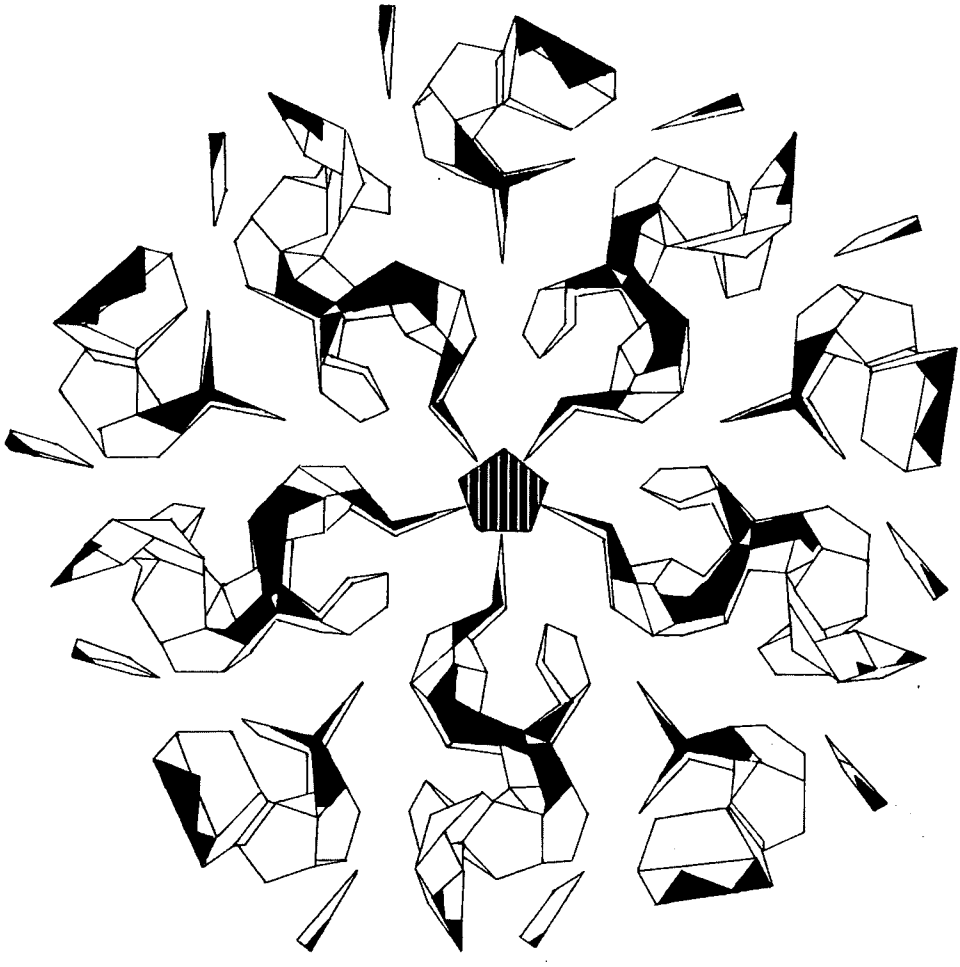
The holes among the building pentagon dodecahedrane units are superficial and internal. The superficial splits are illustrated in our figures by black fields, the internal ones by white fields. To a better understanding the orientation of the system of holes, the basic, central pentagon was also represented in this figure (Text-fig. 6.3.).

The superficial frustrations are very characteristic. The holes surrounding the central pentagon represent the frustrations of the PENROSE-unit of the quasi-crystalloid skeleton. The further ones are larger, and their form is altered in consequence of the arrangement in the space of the spherical calotte.

As regards the internal holes (frustrations sensu NELSON, 1986), a similar phenomenon can be observed near the central unit. The internal holes of the surrounding elements may be grouped into two types. Pentagons of oblique position can be recognized around the first circle of pentagons. Near the border of the spherical calotte several internal holes were demonstrated by the computer modelling with several pentagonal planes. Some of them are more or less similar in size and in position to the central pentagon. These holes are connected to the middle of the sides of the central pentagon. This represents the first system of holes.

The second system of the holes is not connected to the central pentagon, its pointed apices are oriented in the direction of the edges of the central pentagon. Five of such system of holes indicate further five pentagonal planes of the surface. Its arrangement is corresponding to the orientation of the spherical calotte.

Finally, there are further ten surrounding holes (superficial and internal together) in two kinds of orientation. Five are in opposition to one of the ending holes of the "second system of holes". The other five are oriented more or less in the middle of the two systems of holes.



Text-fig. 6.3.

Computer modelled scheme of the superficial frustrations and the inner holes of the dodecahedrane elements of the spherical calotte. The superficial holes (frustrations sensu NELSON 1986) are indicated with black, the inner ones by white fields.

Discussion and Conclusions

1. As it was emphasized previously, this kind of structure modelled in this contribution was not observed directly on biological objects. On the other hand the globular form is extremely common and early at the biological structures.

2. The contradiction between the quasi-periodic and quasi-equivalent symmetries nearly the quasi-crystalloid and the buckminsterfullerene-like symmetries are well known. At our present modelling, the hexagons of the buckyballs were replaced by pentagons. In this way the surface of the spherical calotte and/or the surface of the total sphere is not complete it is full of holes.

3. Taking into consideration the presence of the quasi-periodic and the quasi-equivalent symmetries in living organisms, such kind of biopolymer structure of the biological objects may be presumed. The holes are supposedly filled by another kind of biopolymer structures.

Acknowledgements

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7. MOLECULAR STRUCTURES OF THE PARTIALLY DISSOLVED FOOT LAYER AND ENDEXINE OF PINUS GRIFFITHII MCCLELL POLLEN GRAINS

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Abstract

Pollen grains of *Pinus griffithii* MCCLELL were dissolved partially with pyrrolidine. The molecular systems of the foot layer and the endexine were investigated on highly magnified pictures. The new observations are as follows: 1. Different kinds of molecular structures were observed. 2. Two major types were observed: Chain molecules and microtubular structures. 3. The distances between the centre of the shadows of the atoms are about 1.5–1.6 Å. 4. The bordering between the foot layer and the endexine and the dark and light endexine lamellae are not distinct on molecular level. 5. There are no characteristic molecular differences between the different layers investigated. 6. A common molecular structure is also represented by chain-molecules at the ontogenetically different layers (ectexine and endexine).

Key words: Palynology, recent, *gymnosperm*, molecular system.

Introduction

The sporoderm has several peculiar characteristic features from different points of view. Investigations on this subject were carried out on several levels and methods. One of them is the study of the biopolymer system of the partially degraded wall structures. Taking into consideration the different results more or less well delimited fields of researchs can be distinguished. In our point of view the sporopollenin biopolymer system is in the first place of our interest. The different levels of the organization were summarized in 1989a (KEDVES). In our laboratory several investigations were carried out about the structure and symmetry of the biopolymer system of the plant cell wall. Regarding the so-called sporopollenin type plant cell walls, two major components have been established within the biopolymer system in angstroem dimension: the quasi-crystalloid skeleton and the stabilizing system. The quasi-crystalloid skeleton was investigated with several methods: 1. Two dimensional modelling and symmetry operations, based on the TEM pictures of partially degraded exines (cf. KEDVES 1988, 1989b, 1990, 1991a, KEDVES and FARKAS, 1991, KEDVES, FARKAS, MÉSZÁROS, TÓTH and VÉR, 1991, etc.) 2. Three dimensional modelling (cf. KEDVES, 1991b, 1992). 3. Computer modelling (KEDVES, M. and KEDVES, L., 1994, 1996). The quasi-crystalloid skeleton of the spore-pollen wall was

designed by COLLINSON, HEMSLEY and TAYLOR, W. A. (1993) as mycelles within the colloidal-crystal biopolymer system. Regarding the stabilizing biopolymer structures of the metastable quasi-crystalloid skeleton till this time we have few data (cf. KEDVES and TÓTH, 1994).

The subject of this contribution was planned into the stabilizing biopolymer system investigation research program, based on our previous hypothesis of the molecular symmetry of the organic solvents (GÉVAY and KEDVES, 1989).

The aim of this paper is the evaluation on molecular level the similarities and the differences between the foot layer and endexine, and between the dark and light lamellae of the endexine.

Material and Methods

In our preliminary report (KEDVES and PÁRDUTZ, 1992) we published some data of the results of several experiments. It seems to be useful to cite in this place the previously published methods again which correspond to the present contribution; p. 39: "Experiment No 669: 20 mg air dried pollen material + 5 ml pyrrolidine. Temperature: +5 -5 °C, length of time: 25 days." P. 35: "We have the opportunity to take picture of 400.000 x resolution 2-3.5 Å with the new TEM instrument of the Biological Research Center of the Hungarian Academy of Science (OPTON 902)."

The evaluation of the molecular systems was made on high magnified pictures (5 Million).

Results

The general survey TEM picture (Plate 7.1., fig. 2) well illustrates that the electron density of the foot layer is much more stronger than that of the endexine lamellae. Beneath the foot layer there is a light endexine lamella, "a". Altogether five lamellae are represented in our TEM picture (Plate 7.1., fig. 2). The microphotographs on the magnification of 1 Million well represents the pecularities of the ectexine/endexine bordering on both sides (Plate 7.1., figs. 1,3). It is well illus-

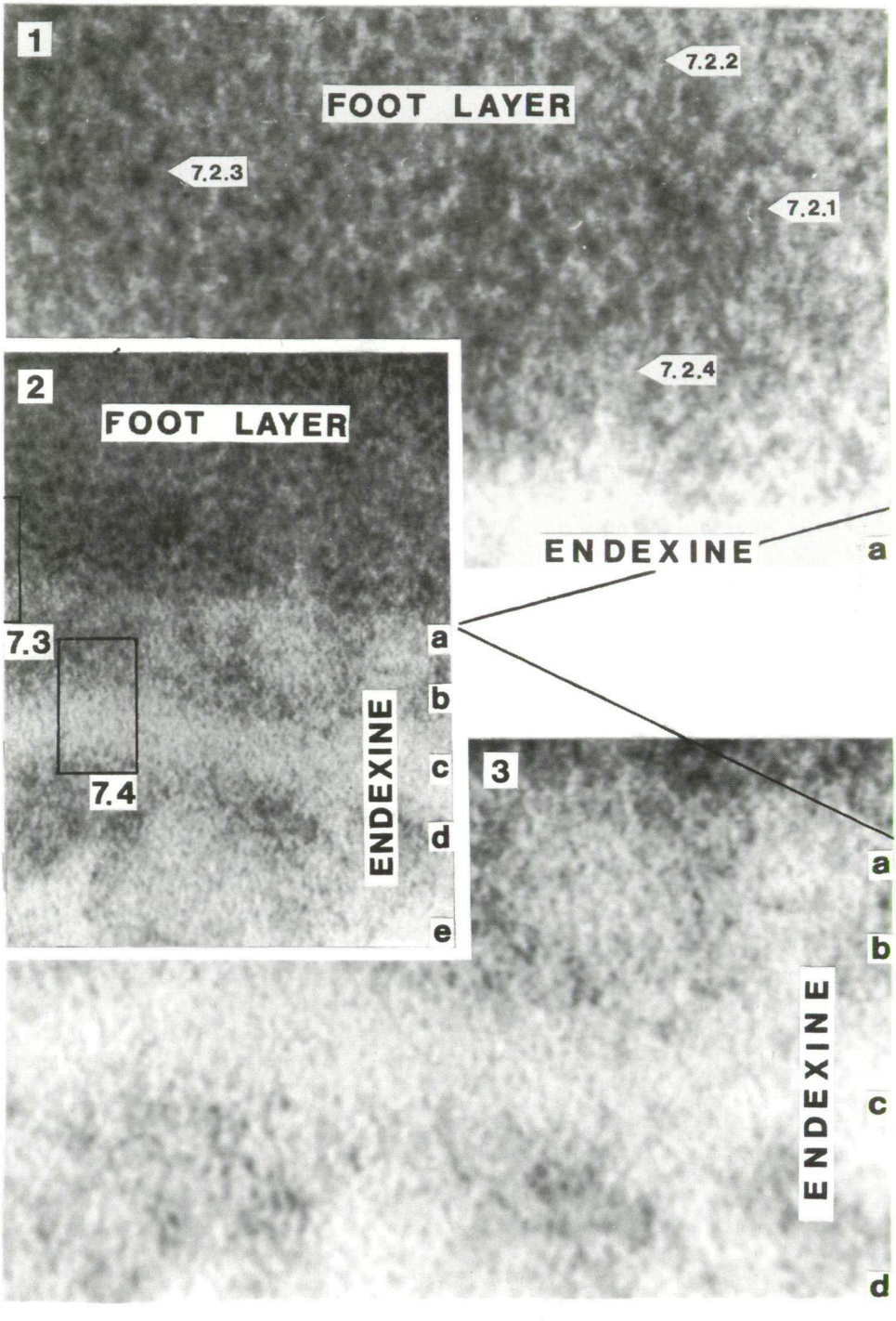
Plate 7.1. ►

1-3. *Pinus griffithii* MCCLELL, Recent. Experiment No: 669, negative no: 435. TEM pictures of the partially dissolved exine.

1. Inner part of the foot layer and the first, outermost (a) endexine lamella. On the foot layer four biopolymer structures are marked with arrows. The numbers of the arrows indicate the highly magnified pictures of these molecular systems; for example 7.2.3. = picture 3, in plate 2, of the present paper, no 7. 1,000.000x.

2. General survey picture of the partially dissolved foot layer and endexine. Five lamellae of the endexine (a – e) are illustrated in this picture. The position of the highly magnified pictures illustrated in the plates 3 and 4 are marked with frames. 500.000x.

3. General survey picture of the bordering part of the foot layer/endexine on biopolymer level. The lowest part of the foot layer, and four endexine lamellae are illustrated. As it is well shown in picture no 1 also, the line of the bordering is not definitely remarkable after partial dissolution. 1,000.000x.


1
FOOT LAYER
7.2.2
7.2.3
7.2.1
7.2.4
ENDEXINE
a
2
FOOT LAYER
7.3
7.4
ENDEXINE
a
b
c
d
e
3
a
b
ENDEXINE
c
d

trated, that at the bordering zone it is not so easy to mark strictly the dividing line. The different kinds of biopolymer structures are also well illustrated in the pictures of Plate 7.1. In the foot layer there are are several microtubular molecular systems, e.g. fig. 1, Plate 7.1., marked with arrows. It is a central unit of 2.5-3.5 Å, surrounded by about 6-8 further units. The total diameter of the microtubular systems is 7-10 Å. The highly magnified pictures of these microtubular molecular systems are illustrated by the magnification of 5 Million in the Plate 7.2., figs. 1-4. As of the molecular structures of the foot layer/endexine bordering, the following can be established; (Plate 7.3.):

1. Several molecular chains were observed oriented in the radial direction of the wall.
2. These chains can also be divided and are continuous from the endexine, and penetrate into the ectexine (foot layer).
3. In this way, one part of the molecular system of the ontogenetically different two layers is common.

To the molecular system of the two kinds of endexine lamellae we can point out as follows (Plate 7.4.):

1. The differences on molecular level between the dark and the light lamellae are not characteristic. Moreover the dividing line between two kinds of lamellae is very obscure. Cf. lamellae b – c – d.
2. Based on our present day knowledges two major molecular components were discovered with this kind of dissolution within the endexine.

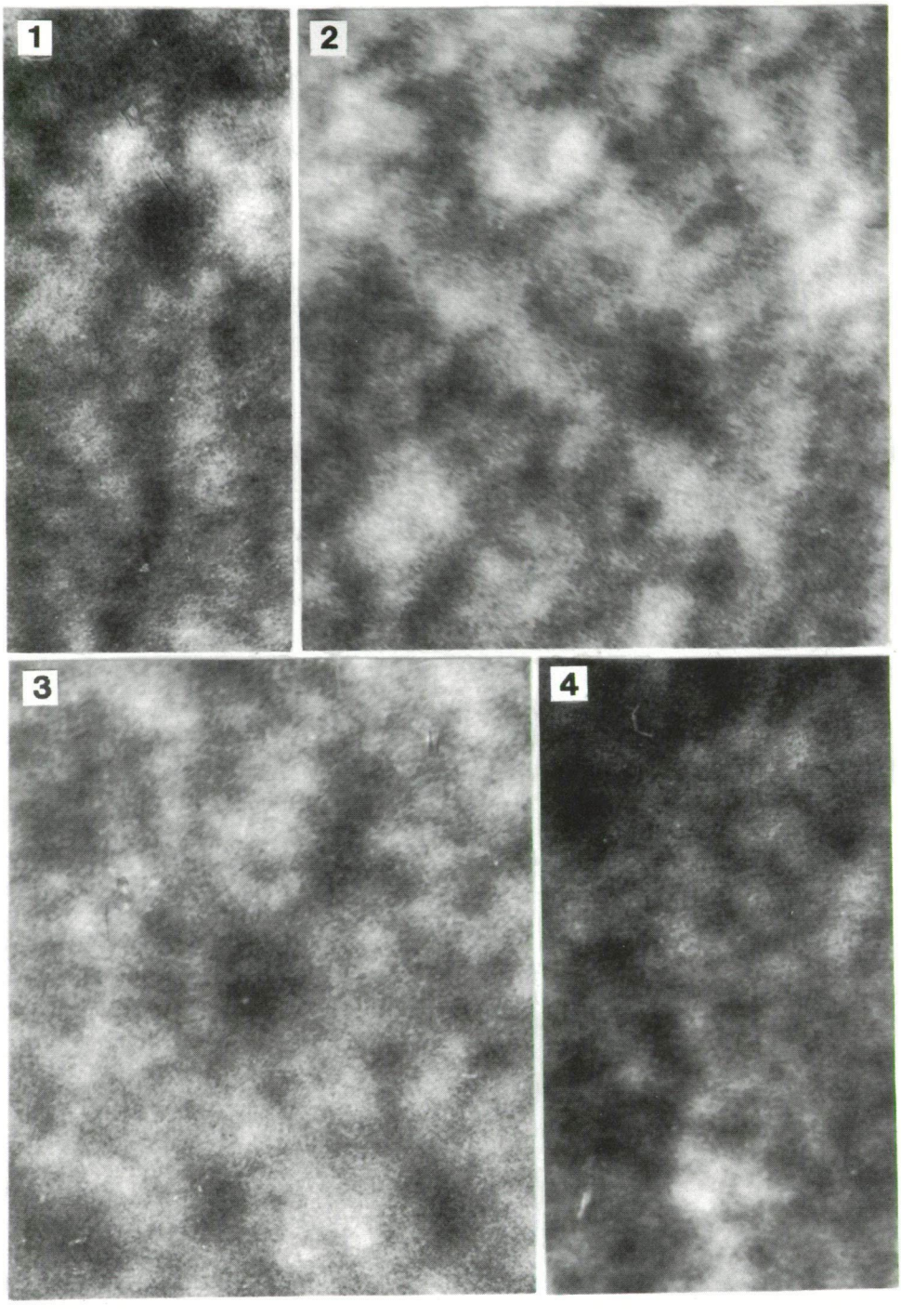
2.1. The radially oriented chain molecules, discussed previously. There are light molecular chains also in all probability these are holes of the dissolved molecules.

2.2. The second component is a strong, electron dense molecular system and fills up the holes between the less electron dense chains-molecules. The molecular symmetry of this component is not yet well known; pro parte presumably globular.

3. It seems that the molecular chain system is more loose within the dark lamellae. In this way the probably globular units with strong electron density are the factors of the dark lamellae. In contrast to this, the more compact chain-molecular system of the light lamella does not contain such molecular structures of strong electron density.
4. The microtubular molecular system which is very common in the foot layer was sporadically observed only in the dark endexine lamellae. The total diameter of the microtubules is about 8–10 Å. The central microchannel is 4 Å large. Till this time this kind of molecular structure had not been observed at the light lamellae of the endexine.

Plate 7.2. ►

1-4. Pinus griffithii McCLELL, Recent. Experiment No: 669, negative no: 435. TEM pictures of the partially dissolved foot layer. The highly magnified pictures of the molecular units marked in fig. 1, plate 7.1. 5,000.000x.


1
2
3
4

Discussion and Conclusions

Based on the molecular structure observed on the highly magnified TEM pictures of the partially degraded foot layer and endexine of the pollen grains of *Pinus griffithii* McClell, the following can be emphasized:

At this experiment in all probability pyrrolidine dissolved the quasi-crystalloid skeleton.

The characteristic stabilizing units described first from the intine of *Pinus griffithii* dissolved partially with diethyl aether were not observed. It may be presumed that pyrrolidine dissolved the whole Penrose system of quasi-crystalloid skeleton and the holes (frustration sensu NELSON, 1986) filling biopolymers.

The more or less radially oriented chain-molecular system is interesting and peculiar.

Concerning the microtubular system the following is worth of mentioning: A similar system was observed during our investigations of the interaction on molecular level of the pollen grains of *Thalictrum flavum* and input the microscopic *Fungi, Gliocladium roseum.* But it is necessary to note the microtubules of *Gliocladium roseum* and *Thalictrum flavum* are smaller (total diameter 2–4 Å) than at the exine of *Pinus griffithii.* This phenomenon seems to be very common on different levels of the molecular systems of the plant cell walls. For example regular pentagonal units were observed in molecular dimensions (sensu strictu), on biopolymer (angstroem dimensions) and finally in nanometer dimension. At the 1st and 2nd cases the quasi-periodic symmetry was demonstrated by KEDVES, FARKAS and TÓTH (1993).

Acknowledgements

This work was financially supported by the Grant OTKA 1/7, T 014692.

Plate 7.3. ►

Pinus griffithii MCCLELL, Recent. Experiment No: 669, negative no: 435. Highly magnified picture of the molecular system of the foot layer/endexine bordering. The position of the illustrated part is marked in picture 2, plate 7.1. 5,000.000x.

ENDEXINE
FOOT LAYER
a

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Plate 7.4. ▸

Pinus griffithii MCCLELL, Recent. Experiment No: 669, negative no: 435. Highly magnified picture of the molecular system of the endexine lamellae b, c and d. The position of the illustrated part is marked in picture 2, plate 7.1. 5,000.000x.

ENDEXINE
b
c
d

8. LIST OF PUBLICATION OF THE LABORATORY UNTIL DECEMBER 1995

compiled by

Á. KÁROSSY

Cell Biological and Evolutionary Micropaleontological Laboratory of the Department of Botany of the J. A. University, H–6701, P. O. Box 993, Szeged, Hungary

GÁSPÁR, I. (1995): Chronicle. – Plant Cell Biology and Development (Szeged) 5, 80–81.

KEDVES, M. (1995): Upper Cretaceous spores from Egypt. – Szeged.

KEDVES, M. – BAGI, I. (1995): Études palynologiques et pédologiques sur les sédiments holocènes de la piscine du Monastère du Mont Jakab. – Plant Cell Biology and Development (Szeged) 5, 60–67.

KEDVES, M. – KEDVES, L. (1995): Computer modelling of the quasi-crystalloid biopolymer structures I. – Plant Cell Biology and Development (Szeged) 5, 68–77.

KEDVES, M., TÓTH, A. – VÉR, A. (1995): Radial fivefold rotation: A new method in the study of the biopolymer organization of the sporoderm. – Plant Cell Biology and Development (Szeged) 5, 44–59.

KEDVES, M. – VARGA, A. (1995): Les pollens de *Thalictrum flavum* infestés par *Gliocladium roseum:* Étude ultrastructurale et analyse des relations mutualistes. Pollen of *Thalictrum flavum* infected by *Gliocladium roseum:* ultrastructural study and analysis of the mutualistic relationships. – APLF 14° Symposium "Palynologie et Changements Globaux", Paris, volume des résumés, 56.

PAPP, ZS. (1995): List of publication of the laboratory until December 1994. – Plant Cell Biology and Development (Szeged) 5, 78–79.

PUGLIESE, N., DROBNE, K., BARATTOLO, F., CAFFAU, M., GALVANI, R., KEDVES, M., MONTENEGRO, M. E., PIRINI-RADRIZZANI, C., PLENIČAR, M. – TURŠNEK, D. (1995): Micro- and macrofossils from K/T boundary through Paleocene in the Northern Adriatic platform. – First Croatian Geological Congress, Opatija, 1–15.

SIEGL-FARKAS, Á. – KEDVES, M. (1995): First occurrence of *Vancampopollenites triangulus* KEDVES and PITTAU 1979 in Hungarian Upper Cretaceous sediments. – Plant Cell Biology and Development (Szeged) 5, 26–32.

Chronicle

Compiled by

E. UNGVÁRI

Visiting scientists

Dr. Philippe MARC (Université Lyon I, F 69622 Villeurbanne Cedex 401 A) visited our laboratory on the 14 and 15th of August. He was interested in the results of the Department of Botany of the J. A. University on the subject of the wood anatomy of fossil remains. In the first place he studied the slides of Prof. Dr. P. GREGUSS, but he was interested in the publications of Dr. P. SIMONCSICS, and Prof. Dr. M. KEDVES as well. Both were former students of Prof. Dr. P. GREGUSS, and before the palynological investigations they worked on the anatomy of the secondary wood.

Prof. Dr. C. ALVAREZ RAMIS (Department of Paleontology, Faculty of Geology, U. C. M., Madrid, Spain) worked in our Laboratory from the lst until the 13th September 1995. During this period she worked together with Prof. Dr. M. KEDVES on the joint research program of the Upper Cretaceous spore-pollen assemblages of Spain. A manuscript was prepared, and submitted for publication in Spain by Prof. Dr. C. ALVAREZ RAMIS;

C. ALVAREZ RAMIS, M. KEDVES, T. FERNÁNDEZ MARRÓN y P. CLEMENTE BELMONTE: Nuevos datos palinologicos sobre las angiospermas primitivas del Cretácico superior de Los Alcores (Guadalix de La Sierra, Madrid).

Dr. Ashvini Kumar SRIVASTAVA Assistant Director (Birbal Sahni Institute of Palaeobotany, Lucknow, Uttar Pradesh, India) visited Szeged in September from 5th until 7th. On the 6th of September he visited the Cell Biological and Evolutionary Micropaleontological Laboratory of the Department of Botany of the J. A. University, and discussed the fossil European and Gondwana Flora of India.

International laboratory activities

20-26 January, 1995 – Lucknow, Uttar Pradesh, India

Prof. Dr. M. KEDVES visited again the Birbal Sahni Institute of Palaeobotany and discussed several subject of the scientists of the world famous Institute, especially with Dr. Shyam C. SRIVASTAVA Assistant Director, Head of Department of Mesophytic, and Dr. Hafiz Ahmed KHAN Secretary, Birbal-Savitri Sahni Foundation. On 24th January at 5 p.m. in the Garden of the Birbal Sahni Museum Dr. KEDVES was awarded with two medals. The medals were handed over by Dr. PATHAK President of the Birbal-Savitri Sahni Foundation. Speakers of the ceremonial act were, Dr. Shyam C. SRIVASTAVA, Dr. H. K. MAHESHWARI and Dr. A. K. KHAN. The award ceremony was finished by a garden party.

5-10 March, 1995 – Tervuren, Belgium

At the 2nd Symposium of African Palynology, on the 7th of March, M. KEDVES presented the following two papers: KEDVES, M. et GÁSPÁR, I.: Altérations secondaires de certains sporomorphes sous l'influence des rayons X.

KEDVES, M.: Paléophytogéographique du Crétacé supérieur de l'Afrique sur la base des données palynologiques.

11-14 March, 1995 – Barcelona, Spain

Prof. Dr. M. KEDVES visited the Departament de Geologia Dinámica, Geofisica i Paleontologia, Facultad de Geologia, Zona Universitaria de Pedralbes, and worked together with Prof. Dr. N. SOLÉ DE PORTA on the spore-pollen assemblages of the Eocene layers of Málaga, Spain. The first part of the results on this subject are presented in this number.

16–19 September, 1995 – Paris, France

At the "14^{e} symposium, Association des Palynologues de langue française, Palynologie et Changement Globaux", on the 19th September, M. KEDVES presented a poster as follows.

KEDVES, M. et VARGA, A.: Les pollens de *Thalictrum flavum* infestés par *Gliocladium roseum:* Étude ultrastructurale et analyse des relations mutualistes. Pollen of *Thalictrum flavum* infected by *Gliocladium roseum:* Ultrastructural study and analysis of the mutualistic relationships.

As non-attending participant at the First Croatian Geological Congress in October 19–22, 1995 Opatija, Croatia, the Laboratory was represented by a contribution as follows.

PUGLIESE, N., DROBNE, K., BARATTOLO, F., CAFFAU, M., GALVANI, R., KEDVES, M., MONTENEGRO, M., PIRINI-RADRIZZANI, C., PLENIČAR, M. and TURŠNEK, D.: Micro- and macrofossils from K/T boundary through Paleocene in the Northern Adriatic Platform.

Hungarian scientific activities

On the 15th of December, 1995, Dr. M. KEDVES presented his habilitations lecture at the Department of Paleontology, Eötvös University, Budapest, Hungary.
Title of the lecture: A zárvatermő növények filogenezise, ősnövényföldrajza a palinológiai eredmények alapján. (Phylogeny and paleophytogeography of the *angiosperms* on the basis of palynological results).

The Commemorative Medal of the Laboratory, as it was mentioned in the introduction was prepared for the 5th anniversary of the official recognition of the Laboratory. The medal represents the emblema of the Laboratory which was completed previously. On the other side, the name of the awarded person is engraved. The realisation of the medal was made by Veronika FÜZ graphic artist, and in the workshop of Géza SZABÓ gold and silversmith master. The medals in 25 specimens were finished on the 24th May, 1995.

The Diploma of the Laboratory was made in the Juhász Printing Office on the 24th July 1995.

Laboratory meetings

27. 01. 1995. Report from the journey of Lucknow, Uttar Pradesh, India, speaker: M. KEDVES.
Preparation of the research programs for 1995, speaker: M. KEDVES.
17. 02. 1995, speaker: GÁSPÁR, I.: Complex study of the spores of *Equisetum arvense.*
Discussion of the up-to-date research programs of the Laboratory. Leader: M. KEDVES.
Report from the flora and fauna of the Everglades, Florida, U. S. A., with diapositive projections, speaker: M. KEDVES.
17. 03. 1995, speaker: GÁSPÁR, I.: Report of his diploma thesis. A very intensive discussion followed this report.
Report from the 2nd A. P. A. I. Symposium held in Tervuren, Belgium, and from the research program made in Barcelona, Spain, speaker: M. KEDVES.
Up-to-date problems of the research programs of the Laboratory, speaker: M. KEDVES.
Diapositive projections from Egypt, and report, speaker: M. KEDVES.
07. 04. 1995. Last discussion of the diploma thesis of GÁSPÁR, I., speaker: I. GÁSPÁR.
Report from Lisboa I., speaker: M. KEDVES.
28. 04. 1995. Up-to-date problems of the Laboratory, speaker: M. KEDVES.
The Botanical Garden of the University of Lisboa, speaker: M. KEDVES.
18. 08. 1995. The first Commemorative Medal of the Laboratory was handed to Prof. Dr. B. CSÁKÁNY in the study of Prof. Dr. M. KEDVES, in a very exclusive reception.
22. 08. 1995. An exclusive reception was in the Laboratory for all members of the Laboratory. On this occasion the laboratory diplomas were distributed to Dr. I. KINCSEK, A. TÓTH and Dr. I. BAGI.
22. 09. 1995, speaker: KEDVES, M.: Report from the 14th A. P. L. F. Symposium, held in Paris.
Discussion of the papers for publication in the 7 number of Plant Cell Biology and Development, speaker: M. KEDVES.
General problems of the Laboratory, speaker: M. KEDVES.
13. 10. 1995, speaker: KEDVES, M.: Preparations to the international scientific meetings of 1996.
Discussion of the papers which will be published in the 7 number of Plant Cell Biology and Development.
Other actual business.

Teaching program of the Laboratory

During the last year the following lectures were delivered:

1. Biopolymer organization and symmetry of the plant cell wall, 1+2 hours weekly,
2. Basic and Applied Palynology, 2+2 hours weekly,
3. Theory of evolution and its natural philosophical relations, 1 lecture weekly.

On the 16 October 1995, a daughter was born to Á. KÁROSSY, named Sonia Rebecca.

Angelika VARGA and István GÁSPÁR married on the 25 November 1995. This is really a "laboratory marriage".

GÁSPÁR, I. from September 1995 as grammar school professor works in the Piarist Grammar-school in Kecskemét.

From May 1995 Dr. M. KEDVES is an active member of the New York Academy of Sciences.

The medals of 1995 (two in India, one from the United States of America and one from the United Kingdom) were mentioned in the contribution of A. TÓTH. This may be completed with the diplomas as follows.

Diplomas from the American Biographical Institute, Raleight, North Carolina U. S. A.
The International Cultural Diploma of Honor,
Most Admired Man of the Decade.
Diplomas from the International Biographical Centre, Cambridge, England, U. K.
Citation of Meritorius Achievement.
International Man of the Year 1994–1995.
The biography of M. KEDVES was published in the following volume: International Who's Who of Intellectuals. Eleventh Edition 1995/96. – International Biographical Centre, Cambridge, England.

In consequence of the economic problems of Hungary, the J. A. University was also forced to reduce its numbers. The Commission of the Biological Departments realized this reduction among others by the retirement of three professors. Prof. Dr. M. KEDVES was also one of this untimely pensioning. But taking into consideration the scientific achievement of the Laboratory, the Rector of the J. A. University, the Dean of the Faculty of Science, the Head of the Department of Botany and the Head of the Laboratory on 13 December 1995 signed an agreement about the function of the Laboratory in the future. Based on this agreement the "status quo" of the Laboratory will not change, and the Head will be for undefined period Prof. Dr. M. KEDVES. In this way, the scientific activity of the Laboratory is unchanged. Many thanks to Prof. Dr. R. MÉSZÁROS, Rector of the J. A. University, to Dr. I. SZABÓ Chancellor of the J. A. University, to Prof. Dr. K. VARGA, Dean of the Faculty of Science and Ass. Prof. Dr. E. MIHALIK, Head of the Department of Botany, who made an effort to save the Laboratory.

Publications of the Laboratory

Plant Cell Biology and Development, against the economic difficulties, till this time appeared regularly. There is hope that this will continue, the Laboratory will get the financial support, cost of printing, and the extremely increased postage.

To increase the scientific value of our publications, the next number will be edited by cooperation of international scientific editorial board. All details will be published in the next number, which will appear in 1997.

Responsible for publication: M. KEDVES
Responsible editor: Á. KÁROSSY
Cover by ZS. PAPP
Set in New Times 10/11 point
Juhász Nyomda, Szeged